US Army Corps of Engineers®

Seattle District

RFP No. W912DW-05-R-0038

FY05 Chapel Complex

Fort Lewis, Washington

Construction Solicitation and Specifications

August 2005

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THIS PROCUREMENT IS:

Open to both Large and Small Business

FORT LEWIS

SITE VISIT:

- A one time site visit for bidders is scheduled for Day, 24 August 2005. Bidders desiring to attend should arrive no later than 10:30 a.m., Local Time, at the U.S. Army Corps of Engineers Northwest Area Office Building 2015 3rd Floor at Fort Lewis, Washington. A temporary 1-day vehicle pass is required to drive on Fort Lewis and may be obtained from the Visitor's Center at the Fort Lewis Main Gate.

- SECURITY: Contractors are required to prove the following information to Shaleigh Daniel, 253-966-4366 FIVE DAYS PRIOR TO THE SITE VISIT in order to secure entry to the Post: Your name, company name, and drivers license. In addition, in order to drive on post, you must show your drivers license, current vehicle registration, proof of insurance and state your destination on post (i.e. Corps of Engineers, Northwest Area Office).

- DIRECTIONS TO NORTHWEST AREA OFFICE: From I-5, take exit 121 (Fort Lewis/North Fort Lewis and proceed to the Visitor's Center just inside and to the right of the Main Gate. Turn right at the 3rd stop light onto Pendleton Avenue. Building 2015 will be on the left behind the Fire Station. Parking is available across the street or
  at the back or side of the building. The Area Office is on the 3rd floor.

- BIDDERS ARE URGED and expected to inspect the site where construction is to be performed and to satisfy themselves as to all general and local conditions which may affect the cost of performance of the contract, to the extent, such information is reasonably obtainable. In no event, will a failure to inspect the site constitute grounds for withdrawal of a bid after opening or for a claim after award of the contract.

BIDDING DOCUMENTS: Register for solicitations at the Internet site:
http://www.nws.usace.army.mil/ct/

PLANHOLDER'S LISTS: Lists may also be obtained from the same site

FOR INQUIRIES, CONTACT THE FOLLOWING INDIVIDUAL Monday through Friday between the hours of 8:00 a.m. and 3:30 p.m.:

ADMINISTRATIVE MATTERS:

Sherrye Schmahl (206)764-6588 FAX: (206)764-6817 sherrye.l.schmahl@usace.army.mil

For Technical Matters, questions must be submitted via the internet on the ProjNet Bid Inquiry website www.projnet.org. To submit inquiries, Bidders will need to enter their email address and the **Bid Inquiry**

Key, shown below. A password is not required. After entering the website, click the Bid tab at top and select Bidder Inquiry. At Bid Inquiry Login page, enter USACE (Agency), enter Key (shown below), and your email address. Click Login. At Create Account page, Bidders need to complete the form only once to create their user accounts. Once a user account is established, Bidders will only need to enter their email address and the Bid Inquiry Key to submit technical inquiries.
After the user account is created, the Select Option page allows Bidders to Post A New Inquiry or View Inquiries. Bidders will receive an email acknowledgement of their question, followed by an email when their question has been answered. Bidder must enter the website to view the actual answer to their question. All submitted questions and responses are viewable to all Bidders at this website.

Bid Inquiry Key **74EGIC-14ADCH**

(Mail) Seattle District Corps of Engineers, P.O. Box 3755, Seattle, WA 98124-3755
(Street) 4735 E. Marginal Way S., Seattle, WA 98134-2385

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CAUTION TO OFFERORS

SECTION TITLE

SF1442 - Pages 00010-1 thru 00010-5 (00010-3 is reserved for use at a later time)
& Subcontracting Plan, Pages 00010-6 thru 00010-15

00100 Bidding Schedule/Instructions to Bidders

00110 Proposal Submission and Evaluations

00600 Representations and Certifications and other Statements of Offerors, and Pre-Award Information

00700 Contract Clauses

00800 Special Clauses, which include the following:

a) Special Clauses Pages 00800-1 thru 00800-15

b) Davis-Bacon General Wage Decision No. WA20030001 AND WA20030002

01000 Technical Specifications

01001 thru 16844

RETURN THE FOLLOWING WITH YOUR PROPOSAL:

SF1442 - Pages 00010-1 thru 00010-5 (00010-3 is reserved for use at a later time)

Section 00600 - Representations and Certifications and Pre-Award Information

20% Bid Bond

*Additionally, if you are a large business you will be required to submit a "Small Business and Small Disadvantaged Business Subcontracting Plan," with your proposal.

** BONDS – Matter of All Seasons Construction, Inc. GAO Decision B-291166.2
Bid Bonds must be accompanied by a Power of Attorney containing an original signature from the surety, which must be affixed to the Power of Attorney after the Power of Attorney has been generated. Computer generated and signed Power's of Attorney will only be accepted if accompanied by an original certification from a current officer of the surety attesting to its authenticity and continuing validity.

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!!! CAUTION TO 0FFERORS !!!

1. **TELEPHONES:** Limited telephone service is provided in the lobby. Only two public telephones may be used by offerors for completing bids.

2. **BUSINESS HOURS:** For the Seattle District Corps of Engineers are from 7:30 A.M. to 4:00 P.M., Monday through Friday.

BEFORE SIGNING AND MAILING THIS OFFER, PLEASE TAKE NOTE OF THE FOLLOWING, AS FAILURE TO PERFORM ANY ONE OF THESE ACTIONS MAY CAUSE YOUR OFFER TO BE REJECTED

3. **AMENDMENTS: Have you acknowledged receipt of ALL** amendments? If in doubt as to the number of amendments issued, please contact the representative listed on the Information Page.

4. **AMENDED BID PAGES: If any of the amendments furnished amended offer pages, the amended offer pages must be used** in submitting your offer.

5. **BID GUARANTEE:** Sufficient bid guarantee in proper form must be furnished **with your offer**. (FOR JOBS EXCEEDING $25,000) See section 00700, FAR 52.228-1

6. **INDIVIDUAL SURETIES:** Please note requirements for Individual Sureties in Section 00100, FAR 52.228-4003.

7. **MISTAKE IN OFFER:** Have you reviewed your offer price for possible errors in calculation or work left out?

8. **TELEGRAPHIC MODIFICATIONS:** The Seattle District does not have the capability of receiving commercial telegrams directly. Offerors who wish to modify their offer by telegram are urged to ensure that telegrams are submitted within enough time to arrive at the designated location. Any doubt as to time should be resolved in favor of **EXTRA TIME.** Transmission by Fax to this office is **NOT ACCEPTABLE**.

9. **OFFER ACCEPTANCE PERIOD:** The minimum offer acceptance period is specified in block 13D of SF1442 (page 00010-1), Solicitation, Offer and Award. Please ensure that you allow at least the stated number of calendar days for the Government to accept your offer.

10. **RFP RESULTS:** A Request for Proposal is a negotiated procurement. As such, offer results are not available on the web. Participants will be notified via letter as to the status of their offer.

11. **CENTRAL CONTRACTOR REGISTRATION:** Per FAR Clause 52.204-7, CENTRAL CONTRACTOR REGISTRATION (OCT 2003), in Section 00700, registration is required prior to award of any contract from a Solicitation issued after May 31, 1998. If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

12. **HUBZONE CERTIFICATION**: Per FAR Clause 52.219-4, NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (Oct 04) in Section 00700. A HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration Reference: https://el.sba.gov:90000/prodhubzone/hubzone/approval.st **.**

13. ***If Applicable to Project Location:*** **COMMERCIAL VEHICLE ACCESS TO FORT LEWIS - REGISTERED AND PREVIOUSLY ID'D (RAPID) GATE PROGRAM: Contractors are urged to review Section 1001 thoroughly as new regulations are in place concerning commercial vehicle access to military sites.**

SOLICITATION, OFFER, AND AWARD *(Construction, Alteration, or Repair)*	1. SOLICITATION NUMBER	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	W912DW-05-R-0038	☐ SEALED BID *(IFB)* ☒ NEGOTIATED *(RFP)*	11 August 2005	1

IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.

4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER	6. PROJECT NUMBER
	W68MD9-5119-5954	

7. ISSUED BY CODE W912DW

Seattle District, Corps of Engineers
ATTN: CENWS-CT-CB
PO Box 3755
Seattle, WA 98124-3755

8. ADDRESS OFFER TO

Seattle District, Corps of Engineers
PO Box 3755 ATTN: CENWS-CT-CB
Seattle, WA 98124-3755

HAND CARRY: Seattle District Corps of Engineers
Contracting Division
4735 East Marginal Way South
Seattle, WA 98134-2329

9. FOR INFORMATION CALL ▶	A. NAME	B. TELEPHONE NUMBER *(Include area code) (NO COLLECT CALLS)*
	SHERRYE SCHMAHL	206-764-6588

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying number, date):*

Furnish all labor, materials and equipment and perform all work for FY05 Chapel Complex Fort Lewis, Washington in accordance with the attached Contract Clauses, Special Clauses, Technical Specifications and Drawings.

NOTE: Award will be made pursuant to the Small Business Competitive Demonstration Program

11. The Contractor shall begin performance within 10 calendar days and complete it within _____ calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See* * Paragraph SC-1, 00800 *.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS? *(If "YES," indicate within how many calendar days after award in Item 12B.)*	12B. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 2 copies to perform the work required are due at the place specified in Item 8 by 2:00 p.m. *(hour)* local time 13 September 2005 *(date).* If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*

Tax ID No: DUNS No:
eMail:

CODE FACILITY CODE

15. TELEPHONE NUMBER *(Include area code)*
Fax No.:

16. REMITTANCE ADDRESS *(Include only if different than Item 14)*

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. *(Insert any number equal or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS ▶ See Page 00010-5

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGEMENT OF AMENDMENTS
(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*

20B. SIGNATURE

20C. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN ▶ ITEM 26
(4 copies unless otherwise specified)

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO
☐ 10 U.S.C. 2304(c) ( ) ☐ 41 U.S.C. 253(c) ( )

26. ADMINISTERED BY CODE
USACE - Seattle District
Northwest Area Office
PO Box 92146
Tillicum, WA 98492-0146

27. PAYMENT WILL BE MADE BY
US Army Corps of Engineers Finance Center
CEFC-AO-P
5722 Integrity Drive
Millington, TN 38054-500

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to the issuing office.)* Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD. *(Contractor is not required to sign this document.)* Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*

31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA
BY

31C. AWARD DATE

IF THE CONTRACTOR IS A CORPORATION OR PARTNERSHIP, THE **APPLICABLE PORTION** OF THE FORM LISTED BELOW MUST BE COMPLETED. IN THE ALTERNATIVE, OTHER EVIDENCE MUST BE SUBMITTED TO SUBSTANTIATE THE AUTHORITY OF THE PERSON SIGNING THE CONTRACT. IF A CORPORATION, **THE SAME OFFICER SHALL NOT EXECUTE BOTH THE CONTRACT AND THE CERTIFICATE**.

CORPORATE CERTIFICATE

I, _____, certify that I am the _____ Secretary of the Corporation named as Contractor herein; that _____, who signed this contract on behalf of the Contractor was then _____of said corporation; that said contract was duly signed for and on behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

_____ (CORPORATE
(Secretary) SEAL)

AUTHORITY TO BIND PARTNERSHIP

This is to certify that the names, signatures and Social Security Numbers of all partners are listed below and that the person signing the contract has authority actually to bind the partnership pursuant to its partnership agreements. Each of the partners individually has full authority to enter into and execute contractual instruments on behalf of said partnership with the United States of America, except as follows: (state "none" or describe limitations, if any) _____

This authority shall remain in full force and effect until such time as the revocation of authority by any cause whatsoever has been furnished in writing to, and acknowledged by, the Contracting Officer.

(Names, Signatures and Social Security Numbers of all Partners)

NAME	SIGNATURE	SOCIAL SECURITY NO.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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SCHEDULE

Item No.	Description of Item	Quantity	Unit	Unit Price	Amount
	BASE ITEMS				
0001	All Work for FY05 Chapel Complex, Except for Items 0002, through 0011	1	JOB	L.S.	$_____
0002	All Work for As-Built Drawings as specified in Section 01702 from preparation to final approval	1	JOB	L.S.	$15,000.00
0003	All Work for O&M Manuals as as specified in Section 01701 from preparation to final approval	1	JOB	L.S.	$30,000.00
0004	All Work for Form 1354 Checklist and Equipment in Place List as specified in Sections 01704 and 01705 from preparation to final approval	1	JOB	L.S.	$10,000.00
	TOTAL BASE ITEMS				$_____
	OPTIONAL ITEMS				
0005	All Work for Free Standing Storage Building	1	JOB	L.S.	$_____
0006	All Work for Landscaping of Parking Islands, Except for Irrigation System	1	JOB	L.S.	$_____
0007	All Work for Planting Areas Adjacent to South Drive, Continuing to 41st Division Drive, Except for Irrigation System	1	JOB	L.S.	$_____
0008	All Work to Landscape Buffer Areas South of the Chapel, Except for Irrigation System	1	JOB	L.S.	$_____
0009	All Work for Lawn Areas, Except for Irrigation System	1	JOB	L.S.	$_____
0010	All Work for Cobble Mulch Area Between Sidewalk and Chapel, Except for Irrigation System	1	JOB	L.S.	$_____
0011	All Work for Irrigation System	1	JOB	L.S.	$_____
	TOTAL OPTIONAL ITEMS				$_____
	TOTAL BASE AND OPTIONAL ITEMS				$_____

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DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

08 August 2005

Contracting Division

SUBJECT: W912DW-05-R-0038, Construction of Chapel Complex with Educational Facilities, Ft. Lewis, WA.

NOTICE TO LARGE BUSINESS FIRMS: (RFP)

Your attention is directed to the contract clauses entitled "Utilization of Small Business Concerns (May 2004) (52.219-8) and "Small Business Subcontracting Plan" (Jan 2002) (52.219-9, Alt II), which are included in this solicitation. If you are a large business, and your offer is **$1,000,000** or more you are required to submit a subcontracting plan **with** your proposal. Award will not be made under this solicitation without a subcontracting plan approved by the Contracting Officer.

As described in the FEDBIZOPS notification, we consider the following goals reasonable and achievable during the performance of the contract resulting from this solicitation. However, final goals will be negotiated prior to contract award. The Subcontracting Plan will then become a material part of your contract.

a. 70% of planned subcontracting dollars can be placed with all small business concerns.

b. 10% of planned subcontracting dollars can be placed with those small business concerns owned and controlled by socially and economically disadvantaged individuals **or** Historically Black Colleges and Universities or Minority Institutions. NOTE: b. is a subset of a.

c. 10% of planned subcontracting dollars for small women-owned businesses. NOTE: c. is a subset of a. Also, the women-owned business may meet the definition of a small disadvantaged business. If so, c. will also be a subset of b. (Count firm in all applicable areas.)

d. 3% of planned subcontracting dollars may be placed with HUBZone small business concerns. NOTE: d. is a subset of a. Note: A HUBZone firm may also SDB, women-owned and/or veteran-owned. Count firm in all applicable areas).

e. 3% of planned subcontracting dollars for veteran-owned small business. NOTE: e. is a subset of a. Go to http:///www. va.gov/osdbu/vetctr.htm or http://www.sba.gov/VETS/ for questions concerning the Veterans Business Development program.

f. 3% of planned subcontracting dollars may be placed with service-disabled veteran-owned small business. NOTE: f. is a subset of a. and e.

Goals included in any proposed plan submitted by you should be at least equal to the ones we are recommending. If lesser goals are proposed, you will have to explain how those goals and your plan represent your best efforts to comply with the policy outlined in the contract clauses. There are a number of equally important aspects of the plan. You should familiarize yourself with the requirements set forth in the contract clauses relating to the subcontracting plan *before* submitting a proposal.

Your plan will be reviewed and scored in accordance with AFARS Appendix DD to ensure it clearly represents your firm's ability to carry out the terms and conditions set forth in the contract clauses. A Subcontracting Plan with a score of less than 70 may not be accepted. It is recommended that you use the enclosed example as a guide to assist you in developing your own subcontracting plan/program. The example is intended to assist you in developing your own subcontracting plan/program. Delete the instructions shown in parenthesis or your plan for subcontracting to small business will not be approved. If discussions during the evaluation of your subcontracting program raises doubts as to your intentions or ability to comply with FAR clause 52.219-9 it could result in your ineligibility for award.

Your plan must address how you will maximize subcontracting opportunities with the small business communities to be found within the project location. Demonstrated outreach efforts through conference attendance, use of the Central Contractor Registration (CCR) Dynamic Small Business Search, corporate support of your Small Business Program Liaison Officer and Small Business Program must be addressed in your subcontracting plan.

Your Small Business Program Managers' attendance at DOD Regional Council Meetings for Small Business Education and Advocacy will be a contract requirement. **DOD Policy Guidance:** In accordance with the Small Business Act, it is the policy of the federal government to aid, assist, and counsel small business to ensure that a fair share of contracts are awarded to small business. Consistent with this, it is the policy of DOD to sponsor regional councils as one significant way to aid, assist, and counsel large business through education and advocacy *of its members who are charged with the responsibility of fulfilling this federal policy*. Therefore, be advised that the individual listed in paragraph 7 of the example will be required to attend these regional council meetings and that attendance must be addressed in your subcontracting plan. Your plan must be submitted with your price proposal.

Should you have any questions or need assistance in DEVELOPING YOUR SUBCONTRACTING PLAN please call the undersigned at (206) 764-6807. If you need TECHNICAL ASSISTANCE call Sherrye Schmahl at (206) 764-6588.

Sincerely,

Mark N. Roush
Director of Small Business

Enclosure

NOTE: This is an example plan. You may use this example as a guide in developing your own Small Business Program. Delete all the instructions (parenthesis), including this message, or your plan will be returned.

SMALL BUSINESS SUBCONTRACTING PLAN

DATE:

CONTRACTOR:

ADDRESS:

PHONE NO:

PROJECT TITLE:

SOLICITATION NO:

1. In accordance with the contract clauses at 52.219-8 and 52.219-9, (name of contractor) submits the following Subcontracting Plan for Small, Small Disadvantaged, and Women-owned Business Concerns.

2. Corresponding dollar values for percentages cited in para. 3 for the base period only:

a. Total contract amount is $_____.

b. Total dollars planned to be subcontracted (to all types of businesses): $_____.

c. Total dollars planned to be subcontracted to small business concerns (including 2d, 2e, 2f, 2g, and 2h below): $_____.

d. Total dollars planned to be subcontracted to small disadvantaged business concerns: $_____.

e. Total dollars planned to be subcontracted to small woman-owned business concerns: $_____.

f. Total dollars planned to be subcontracted to HUBZone small business: $_____.

g. Total dollars planned to be subcontracted to veteran-owned small business concerns $_____.

h. Total dollars planned to be subcontracted to service-disabled veteran-owned small business concerns. $_____.

3. The following percentage goals (expressed in terms of a percentage of total planned subcontracting dollars) are applicable to the contract awarded under the solicitation cited above.

a. Small Business Concerns (2c divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are small business concerns including 3c through 3e.

b. Small Disadvantaged Business Concerns (2g divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are small disadvantaged individuals. **(NOTE: SDB firms must be certified by SBA** and meet the definition under clause 52.219-8(c)(3)).

c. Small Woman-Owned Business Concerns (2h divided by 2b):_____% of total planned subcontracting dollars under this contract will go to subcontractors who are small woman-owned businesses

d. Small HUBZone Business Concerns (2f divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are HUBZone small business contractors. (SEE the definition in contract clause 52.219-8(c) or use the internet: http://www.sba.gov/hubzone/ for further information.)

e. Veteran-owned small business concerns (2d divided by 2b):_____% of total planned subcontracting dollars under this contract will go to subcontractors who are veteran-owned small business.

f. Service-disabled veteran-owned small business concerns (2e divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are service-disabled veteran-owned small business.

4. The principal items or areas we will subcontract under this contract are:

a. Of the items or areas stated in 4; the following are planned to be subcontracted to Small Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

b. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Small Disadvantaged Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

c. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Small Women-Owned Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

d. Of the items or areas stated in 4.a; the following are planned to be subcontracted to HUBZone small business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

e. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Veteran-owned Small Business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

f. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Service-disabled veteran-owned small business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

****NOTE: SEE LAST PAGE IF THIS SOLICITATION HAS OPTION YEARS OR PERIODS** (DELETE THIS STATEMENT FROM YOUR PLAN)******

5. Provide a description of the method your firm used to develop the subcontracting goals in paragraph 3:

6. Indirect costs were ( ) were not ( ) used in establishing subcontracting goals. **If indirect costs are included in your goals, furnish a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns (ii) small disadvantaged business concerns (iii) women-owned small business concerns (iv) HUBZone small business concerns (v) Veteran-owned small business concerns and (vi) Service-disabled veteran-owned concerns **

7. The following individual will administer (name of contractor) Subcontracting Program: (**NOTE TO OFFERORS: The individual named here will be expected to perform and manage your plan and contract clause 52.219-9). Site Construction project managers may not be acceptable as your small business advocate that manages your Corporate Small Business Program).**

Name:_____ Job Title:_____
Address and Telephone Number: _____

This individual's specific duties with regard to the conduct of our firm's Subcontracting Plan will include, but will not be limited to, the following:

a. Developing and maintaining bidders lists of small business, HUBZone small business, small disadvantaged business and women-owned small business concerns using sources such as the CCR Dynamic Small Business Search (http://www.ccr.gov/), State Offices of Minority and Women-owned Business Enterprises, Business Development Agency, US Department of Commerce, Local Minority Business Development Centers, Economic Development Centers, and National Center for American Indian Enterprise Development.

b. Assuring the inclusion of small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns in all solicitations for products or services which they are capable of providing; and ensuring that all solicitations are structured to permit the maximum possible participation by small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

c. Establishing and maintaining records of all solicitations and subcontract awards to ensure that the members of the firm who review bidders proposals documents their reasons for selecting or not selecting a bid submitted by a small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small

business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

d. Preparing and submitting the Subcontracting Report for Individual Contracts (SF 294) and the Summary Subcontract Report (SF 295) in accordance with instructions provided, and coordinating and preparing for all compliance reviews by Federal agencies.

e. Attendance at DOD sponsored training programs in order to develop guidance and training to firm personnel on the policy of the federal government to aid, assist, and counsel small business under this and other government contracts.

f. Conducting or arranging for all other activities necessary to further the intent and attainment of the goals in the Plan to include motivational training of the firm's purchasing personnel, attendance at workshops, seminars and trade fairs conducted by or on behalf of small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

8. The following steps will be taken to ensure that small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns receive notice of and have an equitable opportunity to compete for intended awards of subcontracts and/or purchase orders for the products and/or services describe in paragraph 4 above:

a. Sources will be requested through the CCR Dynamic Small Business Search, business development organizations, minority and small business trade associations and at small, minority, veteran small business and women-owned small business procurement conferences; sources will be contacted; and bidding materials will be provided to all responding parties expressing an interest.

b. Internally, motivational training will be conducted to guide and encourage purchasing personnel; source lists and guides to small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns will be maintained and utilized by purchasing personnel while soliciting subcontracts and purchase orders; activities will be monitored to ensure sufficient time is allowed for interested bidders to prepare their proposals and to evaluate continuing compliance with the Subcontracting Plan.

9. [Name of contractor] agrees that the clause entitled "Utilization of Small Business Concerns" (Oct 2000) will be included in all subcontracts that offer further subcontracting opportunities. All subcontractors, except small business concerns, who receive subcontracts in excess of $500,000 ($1,000,000 in the case of construction) will be required to adopt a subcontracting plan that complies with the requirements of this clause. Such plans will be reviewed to assure that all minimum requirements of an acceptable subcontracting plan have been satisfied.

10. (Name of contractor) agrees to submit such periodic reports and cooperate in any studies or surveys as may be required by the Contracting agency or Small Business Administration in order to determine the extent of compliance by the offeror with the subcontracting plan and with the clause entitled "Utilization of Small Business Concerns" contained in the contract.

11. (Name of Contractor) agrees to maintain at least the following types of records to document compliance with the Subcontracting Plan:

a. The names of all organizations, agencies, and associations contacted for small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns along with records of attendance at conferences, seminars and trade fairs where additional sources were developed.

b. Source lists, guides, and other data identifying small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

c. Records on all subcontract solicitations resulting in an award of more than $100,000 on a contract-by-contract basis, indicating (1) whether small business concerns were solicited, and if not, why not; (2) whether veteran-owned small business concerns were solicited, and if not, why not; (3) whether service-disable veteran-owned small business concerns were solicited, and if not, why not; (4) whether HUBZone small business were solicited, and if not, why not; (5) whether small disadvantaged business concerns were solicited, and if not, why not; and (6) whether small women-owned business concerns were solicited, and if not, why not; and (7) reasons for the failure of solicited small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns to receive a subcontract award.

d. Records of all subcontract award data to include subcontractor's name and address, to be kept on a contract-by-contract basis.

e. Minutes of internal motivational and training meetings held for the guidance and encouragement of purchasing personnel, and records of all monitoring activities performed for compliance evaluation.

f. Copies of SF 294 and SF 295 showing date and place of filing and copies of all other reports or results of reviews conducted by the contracting agency or other interested agencies of the Federal government to monitor our compliance with this Subcontracting Plan.

12. (Name of Contractor) will submit a SF 295, Summary Subcontract Report, on Corps of Engineers projects only. The SF 295 shall be completed and distributed in accordance with the Corps of Engineers Supplemental Instructions. (Name of Contractor) will not report Corps of Engineers projects through any other Agency unless authorized by the Contracting Officer.

13. In closing, (Name of contractor) states that it will be the policy of (Name of contractor) to afford every practicable opportunity for small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns to participate in contracts awarded to (Name of contractor) by the Federal Government, to ensure that equitable opportunity is provided small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns to compete for award of subcontracts and purchase orders, and to diligently pursue the achievement of our goals of participation by small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns in the dollars available for subcontract/purchase order awards under this contract.

BY: _____

_____ DATE:_____

Signature and Title of CEO
Company Name

NOTE: If this solicitation has options (or option periods) , the plan must contain separate goals for ***each*** option or option period (year). EXAMPLE:

	Dollars	Percentage
1. Optional Yr _____ total:	$_____	_____
2. Total to be subcontracted to all types of businesses:	$_____	_____
a. Subcontracted to Small Business (including b, c, d, e, and f below):	$_____	_____
b. Subcontracted to Small Disadvantaged Businesses:	$_____	_____
c. Subcontracted to Women-Owned Small Businesses:	$_____	_____
d. Subcontracted to HUBZone concerns	$_____	_____
e. Subcontracted to Veteran-owned Small Business:	$_____	_____
f. Subcontracted to Service-disabled Veteran-owned Small Business	$_____	_____

1. Optional Yr _____ total:	$_____	_____
2. Total to be subcontracted to all types of businesses:	$_____	_____
a. Subcontracted to Small Business (including b, c, d, e, and f below):	$_____	_____
b. Subcontracted to Small Disadvantaged Businesses:	$_____	_____
c. Subcontracted to Women-Owned Small Businesses:	$_____	_____
d. Subcontracted to HUBZone concerns	$_____	_____
e. Subcontracted to Veteran-owned Small Business:	$_____	_____
f. Subcontracted to Service-disabled Veteran-owned Small Business	$_____	_____

52.204-6	Data Universal Numbering System (DUNS) Number	OCT 2003
52.204-7	Central Contractor Registration	OCT 2003
52.214-34	Submission Of Offers In The English Language	APR 1991
52.214-35	Submission Of Offers In U.S. Currency	APR 1991
52.214-4022	Basis of Award	DEC 1999
52.214-5000	Apparent Clerical Mistakes	MAY 1999
52.215-1	Instructions to Offerors--Competitive Acquisition	JAN 2004
52.216-1	Type Of Contract	APR 1984
52.217-5	Evaluation Of Options	JUL 1990
52.219-4	Notice of Price Evaluation for HUBZone Small Business Concerns	JUL 2005
52.225-12	Notification of Buy American Act Requirement – Construction Materials	JAN 2005
52.228-1	Bid Guarantee	SEPT 1996
52.232-13	Notice Of Progress Payments	APR 1984
52.233-2	Service Of Protest	AUG 1996
52.236-28	Preparation of Proposals--Construction	OCT 1997
52.236-4902	Magnitude of Construction	DEC 1999
252.236-7008	Contract Prices-Bidding Schedules	DEC 1991

CLAUSES INCORPORATED BY FULL TEXT

52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (OCT 2003)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” or “DUNS+4” followed by the DUNS number or “DUNS+4” that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet, Inc. The DUNS+4 is the DUNS number plus a 4-character suffix that may be assigned at the discretion of the offeror to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see Subpart 32.11) for the same parent concern.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number--

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business name.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company physical street address, city, state and Zip Code.

(iv) Company mailing address, city, state and Zip Code (if separate from physical).

(v) Company telephone number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(End of provision)

52.204-7 CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Definitions. As used in this clause--

Central Contractor Registration (CCR) database means the primary Government repository for Contractor information required for the conduct of business with the Government.

Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see the FAR at Subpart 32.11) for the same parent concern.

Registered in the CCR database means that--

(1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database; and

(2) The Government has validated all mandatory data fields and has marked the record “Active”.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” or “DUNS +4” followed by the DUNS or DUNS +4 number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number--

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company Physical Street Address, City, State, and Zip Code.

(iv) Company Mailing Address, City, State and Zip Code (if separate from physical).

(v) Company Telephone Number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)(1)(i) If a Contractor has legally changed its business name, “doing business as” name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the CCR database; (B) comply with the requirements of Subpart 42.12 of the FAR; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-

name agreement, the CCR information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the “Suspension of Payment” paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the “Suspension of payment” paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

52.214-34 SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

52.214-35 SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

Basis of Award (52.214-4022)

Notwithstanding any other provision of this invitation, the Government will award all base bid items as a minimum.

52.214-5000 APPARENT CLERICAL MISTAKES (MAR 1995)--EFARS

(a) For the purpose of initial evaluations of bids, the following will be utilized in the resolving arithmetic discrepancies found on the face of bidding schedule as submitted by the bidder:

(1) Obviously misplaced decimal points will be corrected;

(2) Discrepancy between unit price and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected;

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the government will proceed on the assumption that the bidder intends his bid to be evaluated on basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any

ambiguity concerning which bid is low.
(End of statement)

52.215-1 INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION (JAN 2004)

(a) Definitions. As used in this provision--

“Discussions” are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

“In writing or written” means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

“Proposal modification” is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

“Proposal revision” is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

“Time”, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals. (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Submission, modification, or revision, of proposals.

(i) Offerors are responsible for submitting proposals, and any modifications, or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is “late” and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award. (1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in

evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:

(i) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.

(ii) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.

(iii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.

(iv) A summary of the rationale for award.

(v) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(vi) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.

(End of provision)

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a **Firm-Fixed Price** contract resulting from this solicitation.

(End of clause)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (OCT 2004)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except--

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

___ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JAN 2005)

(a) Definitions. ``Construction material,'' ``designated country construction material,'' ``domestic construction material,'' and ``foreign construction material,'' as used in this provision, are defined in the clause of this solicitation entitled ``Buy American Act--Construction Materials Under Trade Agreements'' (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) Requests for determination of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers. (1) When an offer includes foreign construction material, other than designated country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic or designated country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic or designated country construction material, and the offeror shall be required to furnish such domestic or designated country construction material. An offer based on use of the foreign construction material for which an exception was requested-- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be **20 (twenty)** percent of the bid price or $**3,000,000**, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of clause)

52.232-13 NOTICE OF PROGRESS PAYMENTS (APR 1984)

The need for customary progress payments conforming to the regulations in Subpart 32.5 of the Federal Acquisition Regulation (FAR) will not be considered as a handicap or adverse factor in the award of the contract. The Progress Payments clause included in this solicitation will be included in any resulting contract, modified or altered if necessary in accordance with subsection 52.232-16 and its Alternate I of the FAR. Even though the clause is included in the contract, the clause shall be inoperative during any time the contractor's accounting system and controls are determined by the Government to be inadequate for segregation and accumulation of contract costs.

(End of clause)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from **Cheryl Anderson, Chief Contracting Division, CENWS-CT-CB, P. O. Box 3755, Seattle WA 98124-3755.**

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-28 PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997)

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases, including--

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words “no proposal” in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

(End of provision)

MAGNITUDE OF CONSTRUCTION (FAR 36.204) (52. 236-4902) DEC 1999

(a) Amount of Construction for this solicitation is in the range of **$5,000,000** to **$10,000,000**.

252.236-7008 CONTRACT PRICES - BIDDING SCHEDULES. (DEC 1991)

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for --

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

SECTION 00110
PROPOSAL SUBMISSION AND EVALUATION
Chapel Complex with Educational Facilities, Ft Lewis WA
Solicitation Number W912DW-05-R-0038

1. INTRODUCTION

1.1. Your firm is invited to submit a proposal in response to Request for Proposal (RFP) No. **W912DW-05-R-0038** entitled "Chapel Complex with Educational Facilities, Ft Lewis WA**.**" Prospective offerors are required to prepare and submit proposals that will be evaluated in accordance with this section of the solicitation. In accordance with Federal Acquisition Regulations (FAR), Part 15.101-2, proposals will be evaluated using the lowest price technically acceptable source selection process. The evaluation process will be to first determine those proposals that are technically acceptable, and then from those proposals, determine which firm has the lowest price. The firm offering the technically acceptable lowest price will be awarded the contract. It is the intent of the government to award on initial offers.

1.2. Project Description: This project consists of construction of a new Chapel Complex (33,000 sf) that will include a 400-seat sanctuary and a 451-seat Religious Education Center and 18 classrooms with closed circuit television capability. This project is a LEED Gold designed building which includes using radiant floor heating system. Support facilities will include all utilities, paving, communications, storm drainage, fire alarm system, and site improvements.

2. EVALUATION FACTORS

2.1. Technical Evaluation Factors

2.1.1. The technical evaluation factors identified below will be evaluated on a technically ACCEPTABLE/NON-ACCEPTABLE basis only:

2.1.1.1. Relevant Experience of the Prime
2.1.1.2. Qualifications of Proposed Team Members
2.1.1.3. Past Performance

2.2. Basis of the Source Selection Evaluation - This Section establishes the method to be implemented with regard to the evaluation of the proposals. Evaluation is to be based exclusively on the merits and contents of the proposal, and subsequent discussions should they be required. Offerors not meeting the minimum requirements of ***all*** technical evaluation factors shall be determined to be **NON-ACCEPTABLE** and will not be considered for award. Technical Proposals will be evaluated on an **ACCEPTABLE** or **NON-ACCEPTABLE** basis only**.** Proposals must set forth full, accurate, and complete information as required by this RFP. Absence of information will be deemed as if no support for that factor was provided. Award will be made to the lowest price technically acceptable offeror.

2.2.1. Technical Evaluation Ratings – Definitions

2.2.1.1. Acceptable: An acceptable rating indicates that the offeror has provided sufficient information to meet the **minimum** qualifications/standards described in the technical evaluation factor.

2.2.1.2. Non-Acceptable: A non-acceptable rating indicates that the offeror has not provided sufficient information to meet the **minimum** qualifications/standards described in the technical evaluation factor.

3. GENERAL SUBMITTAL REQUIREMENTS

3.1. Proposals shall be submitted in two parts: (a) **Technical Proposal**, and (b) **Price Proposal**. Each shall be submitted in a separate envelope or package with the type of proposal (i.e., technical or price) clearly printed on the outside of the envelope or package. The maximum number of pages in the technical proposal should not exceed 60 one-sided pages with a font size no smaller than 10 point. Only the first 60 pages will be evaluated. All additional pages over 60 will be rejected and will NOT be evaluated. Offerors submitting proposals should limit submission to data essential for evaluation of proposals so that a minimum of time and moneys are expended in preparing information required by the RFP. Proposals are to be on 8 ½ x 11-inch paper, to the maximum extent practicable, and submitted in standard letter (8½ x 11-inch) hardback loose-leaf binders. Contents of binders shall be tabbed and labeled to afford easy identification from the proposal's Table of Contents. No material shall be incorporated by reference or reiteration of the RFP. Any such material will not be considered for evaluation. The proposal shall be presented in a manner, which allows it to "STAND ALONE" without need for evaluators to reference other documents. Table of Contents, Index Tabs, and Photographs **will not** be considered a page. Unnecessarily elaborate brochures or other presentation materials beyond those sufficient to present complete and effective responses are not desired and may be construed as an indication of the Offeror's lack of cost-consciousness. Penalty for making false statements in proposals is prescribed in 18 U.S.C. 1001. Fax proposals are not acceptable.

4. MINIMUM SUBMITTAL REQUIREMENTS

4.1. Relevant experience of the prime firm -- The Offeror shall submit up to three (3) projects demonstrating relevant experience. "Relevant experience" is defined as experience constructing facilities similar in scope, cost, and complexity to the project in this solicitation, such as chapel projects or educational facilities as described in paragraph 1.2, for either civilian or military use. Specify polished concrete floor experience and LEED experience, if any. Only those projects for which the Offeror was the Prime Contractor and were within the past seven (7) years should be submitted. The projects selected should clearly demonstrate the construction capabilities of the Offeror.

As a minimum, for each project listed, provide:

1) Project title and location
2) Dollar value of construction
3) Construction period (month/year start to month/year end)

4) Description of the project scope of work to include complete description of features which are relevant to this project.
5) Brief description of how the project is relevant, and how it meets the requirements of this RFP project.
6) Current primary point of contact for the customer (name, relationship to project, agency/firm affiliation, city and state, phone number).

4.2. Qualifications of Key Team Members -- The Offeror shall submit the names and résumés for key construction personnel that will be assigned to this project. In addition, the Offeror shall provide a concise summary of the duties and responsibilities for each of the proposed individuals which clearly indicates separate duties and responsibilities for each of the following positions: Project Superintendent, Project Manager, and LEED Accredited Professional. The proposal should clearly present the separate credentials for each position of each person performing the duties of the position to which they are identified. Specify LEED experience, if any. Resumes shall include examples of the proposed key personnel's relevant project experience working on projects of similar size, cost, and complexity to the project in this solicitation, and educational qualifications, if applicable. Each proposed key team member's number of years of experience shall be clearly stated and shown. It is expected that the proposed key team members in your proposal will be the individuals who perform work under the contract. The contracting officer must approve substitute personnel. Résumés should be no more than two (2) pages per individual, and submitted in a format similar to the one below. As a minimum, this factor should include data on the following personnel:

4.2.1. Project Superintendent: The Project Superintendent shall have at least 5 years experience as a project superintendent on construction projects of similar scope, size and complexity as the project in this solicitation. Provide specific project information for each year of experience. The experience must demonstrate construction knowledge and ability to manage construction projects and show consistency with the type of construction in this solicitation.

4.2.2. Project Manager: The Project Manager shall have a baccalaureate degree in a relevant field such as engineering, architecture or construction management (or equivalent), with a minimum of three (3) projects as a Project Manager that demonstrates the ability to construct projects similar in scope, cost and complexity as the project in this solicitation, **or** a person in the construction field with a minimum of 5 years experience as a project manager on projects of the same scope, size and complexity as the project in this solicitation. Provide specific project information for each year of experience. If the proposed candidate received a degree, state as such.

4.2.3. LEED Accredited Professional: The LEED Accredited Professional shall be accredited and shall possess a LEED certificate; submit a copy of the certificate with the proposal. Provide specific project information for at least one LEED accredited project where the proposed LEED Accredited Professional served as the LEED Professional. For the solicited project, the LEED Accredited Professional may serve a dual role as another proposed key team member.

4.2.4. Resume Format For Key Team Members -- Resumes should be no more than two (2) pages per individual and submitted in a format similar to the one below:

RESUME FORMAT
Name and Title
1. Proposed Duties/Functions for this project
2. Firm Affiliation and Years Affiliated
3. Number of years in the construction industry
4. Years of Experience performing duties/functions as proposed for this project.
5. Education – School attended, Degree, Certification, Year, and Specialization
6. List Active Registrations (Professional or Technical Licenses/Certifications)
7. Describe Specific Qualifications for this project
8. List Projects worked on to Include:
Project Title & Location
Scope, Size and Complexity
Duties/Functions
Date of project
9. Demonstrate how each project submitted is relevant to the project to be constructed under this solicitation.

4.3. Past Performance of the Prime -- Past performance of the prime contractor shall be evaluated using the CCASS database. All performance ratings for the past 7 years shall be considered. If an offeror does not have past performance available in CCASS or wishes to augment the CCASS system ratings, the offerors may ask customers to submit the Customer Satisfaction Survey found at the end of this section. For each project constructed for Private Industry or for non-Federal governmental projects not listed in CCASS, provide a completed Customer Satisfaction Survey for each applicable project within the last 7 years. All Customer Satisfaction Surveys must be submitted to the Government from the customer or agency that is providing the information. Further instructions are found at the top of the Customer Satisfaction Survey. A relevant project is one of the same scope, cost and complexity as this solicitation, as defined in paragraph 4.1 above. Should the offerors want to review the CCASS ratings contained in the Corps of Engineers CCASS Database, they may request the information by fax on company letterhead at the following fax number: (503) 808-4596. The Government reserves the right to contact the evaluator on previous Government or Private Sector work to verify the Offeror's construction experience. In the case of an offeror without a record of past performance or for whom information on past performance is not available, the offeror **may not be evaluated as favorable or unfavorable** on past performance (See FAR 15.305(a)(2)(iv)). In the case of an offeror without a record of past performance or for whom information on past performance is not available, the offeror will receive an acceptable rating for this criterion.

4.3.1. Offeror Submitted Surveys. Surveys submitted directly by the offeror may not be considered. Please ensure envelopes containing surveys being submitted to this office do not contain the offeror's return address.

4.3.2 As a maximum, no more than five (5) customer satisfaction surveys will be considered for the prime firm (i.e., the firm signing the Standard Form 1442, Solicitation, Offer and Award) for work not listed (i.e. civilian projects) in the Government CCASS system.

5. PROPOSAL CONTENTS/FORMAT.

5.1. Technical Proposal Format. As a minimum, each copy of the technical proposal should contain the information and follow the general format specified below. Pages should be numbered from beginning to end, without repeating for new sections.

5.2. Technical Proposal Format- Five (5) sets required, original plus four (4) copies.

TECHNICAL PROPOSAL FORMAT
1. Technical Proposal Cover Letter, to include:

a. Solicitation Number
b. Name, address, and telephone and facsimile numbers of the Offeror (and electronic address, if available)
c. A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered.
d. N*ame, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the Offeror's behalf with the Government in connection with this solicitation*
e. Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.
f. Table of Contents. List all sections for the technical proposal. Any future amendments, additions and/or revisions to proposal shall include updated Table of Contents for each set.

2. Relevant Experience data.

3. Qualifications of key team members.

4. Past Performance data.

5.3. Price Proposal Format. The price proposal shall be submitted in an **ORIGINAL plus 1 copy** and must be signed by an official authorized to bind your firm. Note that Standard Form 1442, Block 13D, provides the number of calendar days after the date of the offer for which the proposal is firm. The price proposal, to be submitted at the same time as the technical proposal, should include:

5.4 Price Proposal - Original and one (1) copy
- ***SF 1442, Solicitation, Offer and Award and Award and Corporate certificate***
- ***Acknowledge all amendments by number an date in Block 19 on SF 1442 BACK***
- ***Pricing Schedule***
- ***Section 00600, Representation, Certifications and Other Statements of Offerors and Pre-award Information***
- ***Banking and Bonding information***

5.4 Price Proposal - Original and one (1) copy (continued):
- ***Bid Bond***
- ***Subcontracting plan (large business only)***

5.5. Additional Instructions.

5.5.1. Small Business Subcontracting - Plan Offerors must submit pricing for all items in the Schedule. In addition, **large businesses are required to submit a subcontracting plan** (See FAR Clause 52.219-9 Alt II, Small Business Subcontracting Plan, Oct 2001) with initial price proposals. Award will not be made under this solicitation without an approved subcontracting plan. (See the "Notice to Large Business Firms" located in the front of this solicitation.) Provide the name, point of contact, phone number, and address for the bank and bonding company of the firm signing the SF 1442.

5.5.2. Bid Bonds - Bid Bonds must be accompanied by a Power of Attorney containing an original signature from the surety, which must be affixed to the Power of Attorney after the Power of Attorney has been generated. Computer generated and signed Powers of Attorney will only be accepted if accompanied by an original certification from a current officer of the surety attesting to its authenticity and continuing validity.

6. PROPOSAL EVALUATIONS AND AWARD. A firm fixed-price contract will be awarded to one firm submitting the proposal that:

6.1. Conforms to this Request for Proposals,

6.2. Is the technically acceptable, **lowest price offer, and**

6.3. Is determined to be in the best interest of the Government.

6.4. To be considered for award, proposals shall conform to the terms and conditions contained in the RFP. No proposal shall be accepted that does not address all factors specified in this solicitation or which includes stipulations or qualifying conditions.

6.5. Price. Price will be verified for reasonableness. Financial capacity and bonding ability will be checked.

6.6. Award. It is the intent of the Government to make award based upon the lowest price technically acceptable initial offer, without further discussions or additional information. Therefore, proposals shall be submitted initially on the most favorable terms from a price and technical standpoint. Do not assume you will be afforded the opportunity to clarify, discuss or revise your proposal. If award is not made on initial offers, discussion will be conducted as described below.

6.7. Competitive Range. (FAR 15.306(c))

6.7.1. Competitive Range. After initial evaluation of proposals, if the Contracting Officer determines that discussions are required, the Contracting Officer will establish a competitive range comprised of the technically acceptable proposals. Discussions will be held with firms in the competitive range.

6.7.2. Discussions -- Should discussions be necessary, the Government will conduct written discussions with only those offerors determined to be technically acceptable. If all

proposals are determined to be non-acceptable, at the Contracting Officer's discretion, all firms may be requested to participate in discussions. As a result of discussions, offerors may make revisions to their initial offers. Discussions will culminate in a request for Final Proposal Revision, the date and time of which will be common to all offerors.

7. DEBRIEFINGS

7.1 Pre-award -- Offerors excluded from the competition before award will receive a notice and may request a debriefing before award by submitting a written request for a debriefing to the Contracting Officer within three (3) days after receipt of the notice of exclusion from the competition.

7.2 Post-award -- Unsuccessful Offerors shall request post-award debriefing within three (3) days after the date on which the offeror received notification of contract award. Point-by-point comparisons with other offerors' proposals will not be made, and debriefings will not reveal any information that is not releasable under the Freedom of Information Act.

8. PROPOSAL EXPENSES AND PRECONTRACT COSTS PROPOSAL EXPENSES AND PRECONTRACT COSTS: This RFP does not commit the Government to pay costs incurred in preparation and submission of the initial and any subsequent proposals or any other costs incurred prior to execution of a formal contract.

END OF SECTION 00110 -

SEE CUSTOMER SATISFACTION SURVEY FOLLOWING THIS PAGE

CUSTOMER SATISFACTION SURVEY
RFP W912DW-05-R-0038, Chapel Complex with Educational Facilities, Ft. Lewis, WA

SECTION 1 -- TO BE COMPLETED BY THE OFFEROR AND PROVIDED TO THE CUSTOMER REFERENCED

Name of Firm Being Evaluated: _____

Project Title & Location: _____

Project Dollar Value: _____

Year Completed: _____ **Project Manager:** _____

SECTION 2 - TO BE COMPLETED BY THE CUSTOMER REFERENCED AND MAILED, HAND-DELIVERED,E-MAILED OR FAXED DIRECTLY TO:

U.S. Army Corps of Engineers, Seattle District
Attn: CENWS-CT-CB-MU *(Sherrye L. Schmahl)*
P.O. Box 3755
Seattle, WA 98124-3755
E- Mail: *((Sherrye.L.Schmahl@nws02.usace.army.mil))*

FAX: (206) 764-6817
Street Address:
4735 E. Marginal Way S.
Seattle WA 98134-2329

OVERVIEW: The firm shown above is submitting a proposal on a Seattle District Corps of Engineers project and provided your name as a customer reference. Part of our evaluation process requires information on the firm's past performance. Your participation is important to us and responses are required by the date proposals are due for inclusion in our evaluation. Your assistance is greatly appreciated.

In the blocks below, please indicate your overall level of satisfaction with the work performed by the firm shown in Section 1. Please include additional comments on a separate sheet of paper, including project number found in heading.

ITEM	ITEMS TO EVALUATED FOR THIS PROJECT	ACCEPTABLE	NON - ACCEPTABLE
1	Provided project schedules and completed most major milestones for the project on time.	☐	☐
2	Delivered Quality *(Construction)*?	☐	☐
3	Demonstrated a Willingness to Cooperate	☐	☐
4	Demonstrated Problem Solving Skills?	☐	☐
5	Managed the Project Effectively (including adequate Cost Controls)?	☐	☐
6	Managed Workforce Effectively, to include subcontractors?	☐	☐
7	Provided Adequate Warranty Support?	☐	☐
8	Kept You Informed on current status, problems, conditions, etc that affected the project?	☐	☐
9	Were payments withheld or liquidated damages assessed?	☐	☐
10	Effective subcontract/management plan? Did the firm make subcontracting goals?	☐	☐
11	Would they be your choice on future projects?	☐	☐
	Your OVERALL Level of Customer Satisfaction	**ACCEPTABLE**	**NON-ACCEPTABLE**

Your Name _____ **Phone Number** _____

Firm Name _____

Relationship to this Project: _____

Your assistance in providing this past performance information is appreciated.

52.203-2	Certificate Of Independent Price Determination	APR 1985
52.203-11	Certification And Disclosure Regarding Payments To Influence Certain Federal Transactions	APR 1991
52.204-3	Taxpayer Identification	OCT 1998
52.204-5	Women-Owned Business (Other Than Small Business)	MAY 1999
52.209-5	Certification Regarding Debarment, Suspension, Proposed Debarment, And Other Responsibility Matters	DEC 2001
52.215-6	Place of Performance	OCT 1997
52.219-1 Alt I	Small Business Program Representations (May 2004) Alternate I	APR 2002
52.219-4	Notice of Price Evaluation Preference for HUBZone Small Business Concerns	OCT 2004
52.219-19	Small Business Concerns Representation For The Small Business Competitiveness Demonstration Program	OCT 2000
52.219-21	Small Business Size Representation For Targeted Industry Categories Under The Small Business Competitiveness Demonstration Program	MAY 1999
52.219-22	Small Disadvantaged Business Status	OCT 1999
52.222-22	Previous Contracts And Compliance Reports	FEB 1999
52.222-25	Affirmative Action Compliance	APR 1984
52.222-38	Compliance With Veterans' Employment Reporting Requirements	DEC 2001
52.223-4	Recovered Material Certification	OCT 1997
52.223-13	Certification of Toxic Chemical Release Reporting	AUG 2003
52.236-28	Preparation of Proposals --Construction	OCT 1997
252.209-7001	Disclosure of Ownership or Control by the Government of a Terrorist Country	SEP 2004
252.209-7002	Disclosure Of Ownership Or Control By A Foreign Government	SEP 1994
252.223-7001	Hazard Warning Labels	DEC 1991
252.247-7022	Representation Of Extent Of Transportation Of Supplies By Sea	AUG 1992

CLAUSES INCORPORATED BY FULL TEXT

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to –

(i) Those prices,

(ii) The intention to submit an offer, or

(iii) The methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provison _____ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or

employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(End of provision)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

Common parent, as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

Taxpayer Identification Number (TIN), as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

___ TIN:.----------

___ TIN has been applied for.

___ TIN is not required because:

___ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

___ Offeror is an agency or instrumentality of a foreign government;

___ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

___ Sole proprietorship;

___ Partnership;

___ Corporate entity (not tax-exempt);

___ Corporate entity (tax-exempt);

___ Government entity (Federal, State, or local);

___ Foreign government;

___ International organization per 26 CFR 1.6049-4;

___ Other----------

(f) Common parent.

___ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

___ Name and TIN of common parent:

Name----------

TIN----------

(End of provision)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it ( ) is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that-

(i) The Offeror and/or any of its Principals -

(A) Are ( ) are not ( ) presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have ( ) have not ( ), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are ( ) are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror has ( ) has not ( ), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.215-6 PLACE OF PERFORMANCE (OCT 1997)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, ( ) intends, ( ) does not intend (check applicable block) to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks "intends" in paragraph (a) of this provision, it shall insert in the following spaces the required information:

Place of Performance(Street Address, City, State, County, Zip Code)	Name and Address of Owner and Operator of the Plant or Facility if Other Than Offeror or Respondent

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (MAY 2004) - ALTERNATE I (APR 2002)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is **236220.**

(2) The small business size standard is **$28.5M**.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it ( ) is, ( ) is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it ( ) is, ( ) is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a service-disabled veteran-owned small business concern.

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that--

(i) It ( ) is, ( ) is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It ( ) is, ( ) is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:_____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.) The offeror shall check the category in which its ownership falls:

____ Black American.

____ Hispanic American.

____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

____ Individual/concern, other than one of the preceding.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern--

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; or

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (OCT 2004)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except--

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

___ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) [Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.] The Offeror [ ] is, [ ] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

____ 50 or fewer ____ $1 million or less

____ 51 - 100 ____ $1,000,001 - $2 million

____ 101 - 250 ____ $2,000,001 - $3.5 million

____ 251 - 500 ____ $3,500,001 - $5 million

____ 501 - 750 ____ $5,000,001 - $10 million

____ 751 - 1,000 ____ $10,000,001 - $17 million

____ Over 1,000 ____ Over $17 million

(End of provision)

52.219-21 SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999)

(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

____ 50 or fewer ____ $1 million or less

____ 51 - 100 ____ $1,000,001 - $2 million

____ 101 - 250 ____ $2,000,001 - $3.5 million

____ 251 - 500 ____ $3,500,001 - $5 million

____ 501 - 750 ____ $5,000,001 - $10 million

____ 751 - 1,000 ____ $10,000,001 - $17 million

____ Over 1,000 ____ Over $17 million

(End of provision)

52.219-22 SMALL DISADVANTAGED BUSINESS STATUS (OCT 1999)

(a) General. This provision is used to assess an offeror's small disadvantaged business status for the purpose of obtaining a benefit on this solicitation. Status as a small business and status as a small disadvantaged business for general statistical purposes is covered by the provision at FAR 52.219-1, Small Business Program Representation.

(b) Representations.

(1) General. The offeror represents, as part of its offer, that it is a small business under the size standard applicable to this acquisition; and either--

___ (i) It has received certification by the Small Business Administration as a small disadvantaged business concern consistent with 13 CFR 124, Subpart B; and

(A) No material change in disadvantaged ownership and control has occurred since its certification;

(B) Where the concern is owned by one or more disadvantaged individuals, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(C) It is identified, on the date of this representation, as a certified small disadvantaged business concern in the database maintained by the Small Business Administration(PRO0Net); or

___ (ii) It has submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(2)___ For Joint Ventures. The offeror represents, as part of its offer, that it is a joint venture that complies with the requirements at 13 CFR 124.1002(f) and that the representation in paragraph (b)(1) of this provision is accurate for the small disadvantaged business concern that is participating in the joint venture. [The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture: _____.]

(c) Penalties and Remedies. Anyone who misrepresents any aspects of the disadvantaged status of a concern for the purposes of securing a contract or subcontract shall:

(1) Be punished by imposition of a fine, imprisonment, or both;

(2) Be subject to administrative remedies, including suspension and debarment; and

(3) Be ineligible for participation in programs conducted under the authority of the Small Business Act.

(End of provision)

52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) ( ) It has, ( ) has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) ( ) It has, ( ) has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will

be obtained before subcontract awards.

(End of provision)

52.222-25 AFFIRMATIVE ACTION COMPLIANCE (APR 1984)

The offeror represents that

(a) [ ] it has developed and has on file, [ ] has not developed and does not have on file, at each establishment, affirmative action programs required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or

(b) [ ] has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

(End of provision)

52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

52.223-4 RECOVERED MATERIAL CERTIFICATION (OCT 1997)

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Executive Order 13148, of April 21, 2000, Greening the Government through Leadership in Environmental Management, requires submission of this certification as a prerequisite for contract award.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

( ) (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

( ) (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

( ) (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

( ) (iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(A) Major group code 10 (except 1011, 1081, and 1094.

(B) Major group code 12 (except 1241).

(C) Major group codes 20 through 39.

(D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

( ) (v) The facility is not located within the United States or its outlying areas.

(End of clause)

52.236-28 PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997)

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases, including--

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words “no proposal” in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

(End of provision)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 2004)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries subject to this provision include: Cuba, Iran, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclosure such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

252.209-7002 DISCLOSURE OF OWNERSHIP OR CONTROL BY A FOREIGN GOVERNMENT (SEP 1994)

(a) Definitions. As used in this provision--

(1) "Entity controlled by a foreign government" means--

(i) Any domestic or foreign organization or corporation that is effectively owned or controlled by a foreign government; or

(ii) Any individual acting on behalf of a foreign government.

(2) "Effectively owned or controlled" means that a foreign government or any entity controlled by a foreign government has the power, either directly or indirectly, whether exercised or exercisable, to control or influence the election or appointment of the Offeror's officers, directors, partners, regents, trustees, or a majority of the Offeror's board of directors by means, e.g., ownership, contract, or operation of law.

(3) "Foreign government" means any governing body organized and existing under the laws of any country other than the United States and its possessions and trust territories and any agent or instrumentality of that government.

(4) "Proscribed information" means--

(i) Top Secret information;

(ii) Communications Security (COMSEC) information, except classified keys used to operate secure telephone unites (STU IIIs);

(iii) Restricted Data as defined in the U.S. Atomic Energy Act of 1954, as amended;

(iv) Special Access Program (SAP) information; or

(v) Sensitive Compartmental Information (SCI).

(b) Prohibition on award. No contract under a national security program may be awarded to a company owned by an entity controlled by a foreign government if that company requires access to proscribed information to perform the contract, unless the Secretary of Defense or designee has waived application of 10 U.S.C.2536(a).

(c) Disclosure.
The Offeror shall disclose any interest a foreign government has in the Offeror when that interest constitutes control by a foreign government as defined in this provision. If the Offeror is a subsidiary, it shall also disclose any reportable interest a foreign government has in any entity that owns or controls the subsidiary, including reportable interest concerning the Offeror's immediate parent, intermediate parents, and the ultimate parent. Use separate paper as needed, and provide the information in the following format:

Offeror's Point of Contact for Questions about Disclosure
(Name and Phone Number with Country Code, City Code and Area Code, as applicable)

Name and Address of Offeror

Name and Address of Entity Controlled by a Foreign Government	Description of Interest, Ownership Percentage, and Identification of Foreign Government

(End of provision)

252.223-7001 HAZARD WARNING LABELS (DEC 1991)

(a) "Hazardous material," as used in this clause, is defined in the Hazardous Material Identification and Material Safety Data clause of this contract.

(b) The Contractor shall label the item package (unit container) of any hazardous material to be delivered under this contract in accordance with the Hazard Communication Standard (29 CFR 1910.1200 et seq). The Standard requires that the hazard warning label conform to the requirements of the standard unless the material is otherwise subject to the labeling requirements of one of the following statutes:

(1) Federal Insecticide, Fungicide and Rodenticide Act;

(2) Federal Food, Drug and Cosmetics Act;

(3) Consumer Product Safety Act;

(4) Federal Hazardous Substances Act; or

(5) Federal Alcohol Administration Act.

(c) The Offeror shall list which hazardous material listed in the Hazardous Material Identification and Material Safety Data clause of this contract will be labeled in accordance with one of the Acts in paragraphs (b)(1) through (5) of this clause instead of the Hazard Communication Standard. Any hazardous material not listed will be interpreted to mean that a label is required in accordance with the Hazard Communication Standard.

MATERIAL (If None, Insert "None.")	ACT
_____	_____
_____	_____

(d) The apparently successful Offeror agrees to submit, before award, a copy of the hazard warning label for all hazardous materials not listed in paragraph (c) of this clause. The Offeror shall submit the label with the Material Safety Data Sheet being furnished under the Hazardous Material Identification and Material Safety Data clause of this contract.

(e) The Contractor shall also comply with MIL-STD-129, Marking for Shipment and Storage (including revisions adopted during the term of this contract).

(End of clause)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

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SUBMIT THE FOLLOWING INFORMATION WITH YOUR OFFER
NOTICE TO OFFERORS REGARDING PRE-AWARD INFORMATION

It is requested that the following information be provided with your bid:

1. Company Name and Address: _____

_____

_____

2. Point of Contact:

Name:_____ Phone: (_____)_____

Alt Phone: (_____) _____ Fax: (_____)_____

3. Electronic Transfer Payments will now be required for all new contracts. Do you currently receive Electronic Transfer Payments from this agency? (agency codes 00005524/00006482)

Yes( ) NO( )

4. Name of Bank and Branch _____

_____

Personal Banker _____

Telephone Number _____

Fax Number _____

5. Name of Bonding Agent Company _____

Agents Name _____

Telephone _____

Fax Number _____

6. List three projects that are substantially complete or have been completed within the last two years that are similar to this project. Projects should be listed in the following order: Federal Projects, state projects, city and county projects, than commercial projects. Please provide in the following format:

a) Title & Location of Project _____

Agency/Company _____

Award Amount _____

Point of Contact (Name & Title) _____

Telephone Number _____
Year of Completion_____

b) Title & Location of Project _____

Agency/Company _____

Award Amount _____

Point of Contact (Name & Title) _____

Telephone Number _____
Year of Completion_____

c) Title & Location of Project _____

Agency/Company _____

Award Amount _____

Point of Contact (Name & Title) _____

Telephone Number _____
Year of Completion_____

7) List all outstanding uncompleted projects, in the following format:

a) Title of Project _____

Agency/Company _____

Est. Completion Date _____

Award Amount _____

b) Title of Project _____

Agency/Company _____

Est. Completion Date _____

Award Amount _____

c) Title of Project _____

Agency/Company _____

Est. Completion Date _____

Award Amount _____

END OF SECTION 00600

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52.202-1	Definitions	JUL 2004
52.203-3	Gratuities	APR 1984
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52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2003
52.204-2	Security Requirements	AUG 1996
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.204-7	Central Contractor Registration	OCT 2003
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JAN 2005
52.212-4007	Environmental Litigation	NOV 1999
52.215-2	Audit and Records--Negotiation	JUN 1999
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52.215-21	Requirement for Cost or Pricing Data or Information Other Than Cost or Pricing Data – Modifications	OCT 1997
52.219-4	Notice of Price Evaluation Preference for HUBZone Small Business Concerns	OCT 2004
52.219-8	Utilization of Small Business Concerns	MAY 2004
52.219-9 Alt II	Small Business Subcontracting Plan (Jan 2002) Alternate II	OCT 2001
52.219-16	Liquidated Damages-Subcontracting Plan	JAN 1999
52.219-25	Small Disadvantaged Business Participation Program--Disadvantaged Status and Reporting	OCT 1999
52.222-1	Notice To The Government Of Labor Disputes	FEB 1997
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52.222-8	Payrolls and Basic Records	FEB 1988
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52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	FEB 1988
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52.222-14	Disputes Concerning Labor Standards	FEB 1988
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52.222-26	Equal Opportunity	APR 2002
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52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	DEC 2001
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	DEC 2001
52.223-3	Hazardous Material Identification And Material Safety Data	JAN 1997
52.223-5	Pollution Prevention and Right-to-Know Information	AUG 2003
52.223-6	Drug-Free Workplace	MAY 2001
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52.233-1	Disputes	JUL 2002
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252.204-7000	Disclosure Of Information	DEC 1991
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252.204-7004 Alt A	Central Contractor Registration (52.204-7) Alternate A	NOV 2003
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
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252.215-7000	Pricing Adjustments	DEC 1991
252.219-7003	Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan (DOD Contracts)	APR 1996
252.223-7004	Drug Free Work Force	SEP 1988
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252.226-7001	Utilization of Indian Organizations and Indian-Owned Economic Enterprises, and Native Hawaiian Small Business Concerns	SEP 2004
252.227-7023	Drawings and Other Data to become Property of Government	MAR 1979
252.227-7033	Rights in Shop Drawings	APR 1966
252.231-7000	Supplemental Cost Principles	DEC 1991
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252.242-7000	Postaward Conference	DEC 1991
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.247-7023	Transportation of Supplies by Sea	MAY 2002
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PIL 2003-06	Security Contract Language for all Corps of Engineers' Unclassified Contracts	FEB 2003

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Successor Contracting Officers (52.201-4001)

The Contracting Officer who signed this contract is the primary Contracting Officer for the contract. Neverthless, any Contracting Officer assigned to the Seattle District and acting within his/her authority may take formal action on this contract when a contract action needs to be taken and the primary Contracting Officer is unavailable.

52.202-1 DEFINITIONS (JUL 2004)

(a) When a solicitation provision or contract clause uses a word or term that is defined in the Federal Acquisition Regulation (FAR), the word or term has the same meaning as the definition in FAR 2.101 in effect at the time the solicitation was issued, unless--

(1) The solicitation, or amended solicitation, provides a different definition;

(2) The contracting parties agree to a different definition;

(3) The part, subpart, or section of the FAR where the provision or clause is prescribed provides a different meaning; or

(4) The word or term is defined in FAR Part 31, for use in the cost principles and procedures.

(b) The FAR Index is a guide to words and terms the FAR defines and shows where each definition is located. The FAR Index is available via the Internet at http://www.acqnet.gov at the end of the FAR, after the FAR Appendix.

(End of clause)

52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

52.203-7 ANTI-KICKBACK PROCEDURES. (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or

subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold, from sums owed a subcontractor under the prime contract, the amount of any kickback. The Contracting Officer may order the monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including this subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed $100,000.

52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27(a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 2003)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under Title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3),Title 37, United States Code.

(3) A special Government employee, as defined in section 202, Title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, Title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submis sion that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

State, as used in this clause, means a State of the United States, the District of Columbia, or an outlying area of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of Title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or

employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or

pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding $100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the

calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

52.204-2 SECURITY REQUIREMENTS (AUG 1996)

(a) This clause applies to the extent that this contract involves access to information classified "Confidential," "Secret," or "Top Secret."

(b) The Contractor shall comply with (1) the Security Agreement (DD Form 441), including the National Industrial Security Program Operating Manual (DOD 5220.22-M); and (2) any revisions to that manual, notice of which has been furnished to the Contractor.

(c) If, subsequent to the date of this contract, the security classification or security requirements under this contract are changed by the Government and if the changes cause an increase or decrease in security costs or otherwise affect any other term or condition of this contract, the contract shall be subject to an equitable adjustment as if the changes were directed under the Changes clause of this contract.

(1) The Contractor agrees to insert terms that conform substantially to the language of this clause, including this paragraph (d) but excluding any reference to the Changes clause of this contract, in all subcontracts under this contract that involve access to classified information.

(End of clause)

52.204-4 PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)

(a) Definitions. As used in this clause--

“Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.” For paper and paper products, postconsumer material means “postconsumer fiber” defined by the U.S. Environmental Protection Agency (EPA) as--

(1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or

(2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not

(3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

“Printed or copied double-sided” means printing or reproducing a document so that information is on both sides of a sheet of paper.

“Recovered material,” for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as “recovered fiber” and means the following materials:

(1) Postconsumer fiber; and

(2) Manufacturing wastes such as--

(i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and

(ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.

(c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

52.204-7 CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Definitions. As used in this clause--

Central Contractor Registration (CCR) database means the primary Government repository for Contractor information required for the conduct of business with the Government.

Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see the FAR at Subpart 32.11) for the same parent concern.

Registered in the CCR database means that--

(1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database; and

(2) The Government has validated all mandatory data fields and has marked the record “Active”.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” or “DUNS +4” followed by the DUNS or DUNS +4 number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number--

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company Physical Street Address, City, State, and Zip Code.

(iv) Company Mailing Address, City, State and Zip Code (if separate from physical).

(v) Company Telephone Number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)(1)(i) If a Contractor has legally changed its business name, “doing business as” name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the CCR database; (B) comply with the requirements of Subpart 42.12 of the FAR; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-name agreement, the CCR information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the “Suspension of Payment” paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the “Suspension of payment” paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JAN 2005)

(a) The Government suspends or debars Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the $25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed $25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the in the Excluded Parties List System). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being in the Excluded Parties List System.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion in the Excluded Parties List System.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.212-4007 ENVIRONMENTAL LITIGATION

(a) If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer, at the request of the Contractor, shall determine whether the order is due in any part to the acts or omissions of the Contractor or a Subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor or a Subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Contracting Officer in the administration of this contract under the terms of the "Suspension of Work" clause of this contract. The period of such suspension, delay or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

(b) The term "environmental litigation", as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantially or procedurally, the effect of the work on the environment.

52.215-2 AUDIT AND RECORDS--NEGOTIATION (JUN 1999)

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Examination of costs. If this is a cost-reimbursement, incentive, time-and-materials, labor-hour, or price redeterminable contract, or any combination of these, the Contractor shall maintain and the Contracting Officer, or an authorized representative of the Contracting Officer, shall have the right to examine and audit all records and other evidence sufficient to reflect properly all costs claimed to have been incurred or anticipated to be incurred directly or indirectly in performance of this contract. This right of examination shall include inspection at all reasonable times of the Contractor's plants, or parts of them, engaged in performing the contract.

(c) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with any pricing action relating to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right

to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the contract, subcontract, or modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the contract, subcontract, or modification; or

(4) Performance of the contract, subcontract or modification.

(d) Comptroller General--(1) The Comptroller General of the United States, or an authorized representative, shall have access to and the right to examine any of the Contractor's directly pertinent records involving transactions related to this contract or a subcontract hereunder.

(2) This paragraph may not be construed to require the Contractor or subcontractor to create or maintain any record that the Contractor or subcontractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) Reports. If the Contractor is required to furnish cost, funding, or performance reports, the Contracting Officer or an authorized representative of the Contracting Officer shall have the right to examine and audit the supporting records and materials, for the purpose of evaluating (1) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports and (2) the data reported.

(f) Availability. The Contractor shall make available at its office at all reasonable times the records, materials, and other evidence described in paragraphs (a), (b), (c), (d), and (e) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in Subpart 4.7, Contractor Records Retention, of the Federal Acquisition Regulation (FAR), or for any longer period required by statute or by other clauses of this contract. In addition--

(1) If this contract is completely or partially terminated, the Contractor shall make available the records relating to the work terminated until 3 years after any resulting final termination settlement; and

(2) The Contractor shall make available records relating to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to this contract until such appeals, litigation, or claims are finally resolved.

(g) The Contractor shall insert a clause containing all the terms of this clause, including this paragraph (g), in all subcontracts under this contract that exceed the simplified acquisition threshold, and--

(1) That are cost-reimbursement, incentive, time-and-materials, labor-hour, or price-redeterminable type or any combination of these;

(2) For which cost or pricing data are required; or

(3) That require the subcontractor to furnish reports as discussed in paragraph (e) of this clause.

The clause may be altered only as necessary to identify properly the contracting parties and the Contracting Officer under the Government prime contract.

(End of clause)

52.215-11 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, except that this clause does not apply to any modification if an exception under FAR 15.403-1 applies.

(b) If any price, including profit or fee, negotiated in connection with any modification under this clause, or any cost reimbursable under this contract, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which--

(1) The actual subcontract; or

(2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the “as of” date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data were known by the Contractor to be understated before the “as of” date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the “as of” date specified on its Certificate of Current Cost or Pricing Data.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data that were incomplete, inaccurate, or noncurrent.

(End of clause)

52.215-13 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall--

(1) Become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4; and

(2) Be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4 on the date of agreement on price or the date of award, whichever is later.

(End of clause)

52.215-21 REQUIREMENTS FOR COST OR PRICING DATA OR INFORMATION OTHER THAN COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) Exceptions from cost or pricing data. (1) In lieu of submitting cost or pricing data for modifications under this

contract, for price adjustments expected to exceed the threshold set forth at FAR 15.403-4 on the date of the agreement on price or the date of the award, whichever is later, the Contractor may submit a written request for exception by submitting the information described in the following subparagraphs. The Contracting Officer may require additional supporting information, but only to the extent necessary to determine whether an exception should be granted, and whether the price is fair and reasonable--

(i) Identification of the law or regulation establishing the price offered. If the price is controlled under law by periodic rulings, reviews, or similar actions of a governmental body, attach a copy of the controlling document, unless it was previously submitted to the contracting office.

(ii) Information on modifications of contracts or subcontracts for commercial items. (A) If--

(1) The original contract or subcontract was granted an exception from cost or pricing data requirements because the price agreed upon was based on adequate price competition or prices set by law or regulation, or was a contract or subcontract for the acquisition of a commercial item; and

(2) The modification (to the contract or subcontract) is not exempted based on one of these exceptions, then the Contractor may provide information to establish that the modification would not change the contract or subcontract from a contract or subcontract for the acquisition of a commercial item to a contract or subcontract for the acquisition of an item other than a commercial item.

(B) For a commercial item exception, the Contractor shall provide, at a minimum, information on prices at which the same item or similar items have previously been sold that is adequate for evaluating the reasonableness of the price of the modification. Such information may include--

(1) For catalog items, a copy of or identification of the catalog and its date, or the appropriate pages for the offered items, or a statement that the catalog is on file in the buying office to which the proposal is being submitted. Provide a copy or describe current discount policies and price lists (published or unpublished), e.g., wholesale, original equipment manufacturer, or reseller. Also explain the basis of each offered price and its relationship to the established catalog price, including how the proposed price relates to the price of recent sales in quantities similar to the proposed quantities.

(2) For market-priced items, the source and date or period of the market quotation or other basis for market price, the base amount, and applicable discounts. In addition, describe the nature of the market.

(3) For items included on an active Federal Supply Service Multiple Award Schedule contract, proof that an exception has been granted for the schedule item.

(2) The Contractor grants the Contracting Officer or an authorized representative the right to examine, at any time before award, books, records, documents, or other directly pertinent records to verify any request for an exception under this clause, and the reasonableness of price. For items priced using catalog or market prices, or law or regulation , access does not extend to cost or profit information or other data relevant solely to the Contractor's determination of the prices to be offered in the catalog or marketplace.

(b) Requirements for cost or pricing data. If the Contractor is not granted an exception from the requirement to submit cost or pricing data, the following applies:

(1) The Contractor shall submit cost or pricing data and supporting attachments in accordance with Table 15-2 of FAR 15.408.

As soon as practicable after agreement on price, but before award (except for unpriced actions), the Contractor shall submit a Certificate of Current Cost or Pricing Data, as prescribed by FAR 15.406-2.

(End of clause)

52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (OCT 2004)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except--

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

___ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (MAY 2004)

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

Definitions. As used in this contract--

HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

Small business concern means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

Small disadvantaged business concern means a small business concern that represents, as part of its offer that--

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, subpart B;

(2) No material change in disadvantaged ownership and control has occurred since its certification;

(3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed $750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

Women-owned small business concern means a small business concern--

(1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (JAN 2002)--ALTERNATE II (OCT 2001).

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause--

“Commercial item” means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

“Commercial plan” means a subcontracting plan (including goals) that covers the offeror’s fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

"Individual contract plan" means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of the specific contract except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

"Master plan" means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

"Subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) Proposals submitted in response to this solicitation shall include a subcontracting plan that separately addresses subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate a subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of --

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(iv) Total dollars planned to be subcontracted to service-disabled veteran-owned small business;

(v) Total dollars planned to be subcontracted to HUBZone small business concerns;

(vi) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(vii) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to --

(i) Small business concerns,

(ii) Veteran-owned small business concerns;

(iii) Service-disabled veteran-owned small business concerns;

(iv) HUBZone small business concerns;

(v) Small disadvantaged business concerns, and

(vi) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned small, service-disabled veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business source list. Use of PRO-Net as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, or publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with --

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) Service-disabled veteran-owned small business concerns;

(iv) HUBZone small business concerns;

(v) Small disadvantaged business concerns; and

(vi) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a plan similar to the plan that complies with the requirements of this clause.

(10) Assurances that the offeror will --

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the paragraph (j) of this clause. The reports shall provide information on subcontract awards to small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, women-owned small business concerns, and Historically Black Colleges and Universities and Minority Institutions. Reporting shall be in accordance with the instructions on the forms or as provided in agency regulations.

(iv) Ensure that its subcontractors agree to submit SF 294 and 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating --

(A) Whether small business concerns were solicited and if not, why not;

(B) Whether veteran-owned small business concerns were solicited and, if not, why not;

(C) Whether service-disabled veteran-owned small business concerns were solicited and, if not, why not;

(D) Whether HUBZone small business concerns were solicited and, if not, why not;

(E) Whether small disadvantaged business concerns were solicited and if not, why not;

(F) Whether women-owned small business concerns were solicited and if not, why not; and

(G) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact --

(A) Trade associations;

(B) Business development organizations;

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources; and

(D) Veterans service organizaions.

(v) Records of internal guidance and encouragement provided to buyers through --

(A) Workshops, seminars, training, etc., and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, veteran-owned small business, HUBZone small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided --

(1) The master plan has been approved;

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with --

(1) The clause of this contract entitled “Utilization Of Small Business Concerns;” or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor’s format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by North American Industry Classification System (NAICS) Industry Subsector. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant NAICS Industry Subsector and report all awards to that subcontractor under its predominant NAICS Industry Subsector.

(End of clause)

52.219-16 LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (JAN 1999)

(a) Failure to make a good faith effort to comply with the subcontracting plan, as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion or, in the case of a commercial plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled “Small Business Subcontracting Plan,” the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer who approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies with contracts covered by the commercial plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

52.219-25 SMALL DISADVANTAGED BUSINESS PARTICIPATION PROGRAM—DISADVANTAGED STATUS AND REPORTING (OCT 1999)

(a) Disadvantaged status for joint venture partners, team members, and subcontractors. This clause addresses disadvantaged status for joint venture partners, teaming arrangement members, and subcontractors and is applicable if this contract contains small disadvantaged business (SDB) participation targets. The Contractor shall obtain representations of small disadvantaged status from joint venture partners, teaming arrangement members, and subcontractors through use of a provision substantially the same as paragraph (b)(1)(i) of the provision at FAR 52.219-22, Small Disadvantaged Business Status. The Contractor shall confirm that a joint venture partner, team member, or subcontractor representing itself as a small disadvantaged business concern, is identified as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net) or by contacting the SBA's Office of Small Disadvantaged Business Certification and Eligibility.

(b) Reporting requirement. If this contract contains SDB participation targets, the Contractor shall report on the participation of SDB concerns at contract completion, or as otherwise provided in this contract. Reporting may be on Optional Form 312, Small Disadvantaged Business Participation Report, or in the Contractor's own format providing the same information. This report is required for each contract containing SDB participation targets. If this contract contains an individual Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, reports may be submitted with the final Subcontracting Report for Individual Contracts (Standard Form 294) at the completion of the contract.

(End of clause)

52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997)

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(End of clause)

52.222-3 CONVICT LABOR (JUN 2003)

(a) Except as provided in paragraph (b) of this clause, the Contractor shall not employ in the performance of this contract any person undergoing a sentence of imprisonment imposed by any court of a State, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands.

(b) The Contractor is not prohibited from employing persons--

(1) On parole or probation to work at paid employment during the term of their sentence;

(2) Who have been pardoned or who have served their terms; or

(3) Confined for violation of the laws of any of the States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(i) The worker is paid or is in an approved work training program on a voluntary basis;

(ii) Representatives of local union central bodies or similar labor union organizations have been consulted;

(iii) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;

(iv) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(v) The Attorney General of the United States has certified that the work-release laws or **regulations** of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION. (SEP 2000)

(a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting Officer will assess liquidated damages at the rate of $10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and

actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding $100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of clause)

52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(2) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such

records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

52.222-11 SUBCONTRACTS (LABOR STANDARDS (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act-Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(ii) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
[Insert Goals]	[Insert Goals]

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is [Contracting Officer shall insert description of the geographical areas where the contract is to be performed, giving the State, county, and city].

(End of provision)

52.222-26 EQUAL OPPORTUNITY (APR 2002)

(a) Definition. United States, as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of $10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (FEB 1999)

(a) Definitions. "Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of $10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor,

or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

52.222-35 EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Definitions. As used in this clause--

All employment openings means all positions except executive and top management, those positions that will be filled from within the Contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment.

Executive and top management means any employee--

(1) Whose primary duty consists of the management of the enterprise in which the individual is employed or of a customarily recognized department or subdivision thereof;

(2) Who customarily and regularly directs the work of two or more other employees;

(3) Who has the authority to hire or fire other employees or whose suggestions and recommendations as to the hiring or firing and as to the advancement and promotion or any other change of status of other employees will be given particular weight;

(4) Who customarily and regularly exercises discretionary powers; and

(5) Who does not devote more than 20 percent or, in the case of an employee of a retail or service establishment, who does not devote more than 40 percent of total hours of work in the work week to activities that are not directly and closely related to the performance of the work described in paragraphs (1) through (4) of this definition. This paragraph (5) does not apply in the case of an employee who is in sole charge of an establishment or a physically separated branch establishment, or who owns at least a 20 percent interest in the enterprise in which the individual is employed.

Other eligible veteran means any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

Positions that will be filled from within the Contractor's organization means employment openings for which the Contractor will give no consideration to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings the Contractor proposes to fill from regularly established “recall” lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

Qualified special disabled veteran means a special disabled veteran who satisfies the requisite skill, experience, education, and other job-related requirements of the employment position such veteran holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

Special disabled veteran means--

(1) A veteran who is entitled to compensation (or who but for the receipt of military retired pay would be entitled to compensation) under laws administered by the Department of Veterans Affairs for a disability--

(i) Rated at 30 percent or more; or

(ii) Rated at 10 or 20 percent in the case of a veteran who has been determined under 38 U.S.C. 3106 to have a serious employment handicap (i.e., a significant impairment of the veteran's ability to prepare for, obtain, or retain employment consistent with the veteran's abilities, aptitudes, and interests); or

(2) A person who was discharged or released from active duty because of a service-connected disability.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days and was discharged or released from active duty with other than a dishonorable discharge, if any part of such active duty occurred--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases; or

(2) Was discharged or released from active duty for a service-connected disability if any part of the active duty was performed--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases.
(b) General. (1) The Contractor shall not discriminate against the individual because the individual is a special disabled veteran, a veteran of the Vietnam era, or other eligible veteran, regarding any position for which the employee or applicant for employment is qualified. The Contractor shall take affirmative action to employ, advance in employment, and otherwise treat qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff and rehiring;

(iii) Rate of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeship, and on-the-job training under 38 U.S.C. 3687, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor shall comply with the rules, regulations, and relevant orders of the Secretary of Labor issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended (38 U.S.C. 4211 and 4212).

(c) Listing openings. (1) The Contractor shall immediately list all employment openings that exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract, and including those occurring at an establishment of the Contractor other than the one where the contract is being performed, but excluding those of independently operated corporate affiliates, at an appropriate local public employment service office of the State wherein the opening occurs. Listing employment openings with the U.S. Department of Labor's America's Job Bank shall satisfy the requirement to list jobs with the local employment service office.

(2) The Contractor shall make the listing of employment openings with the local employment service office at least concurrently with using any other recruitment source or effort and shall involve the normal obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing of employment openings does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(3) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State public employment agency in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State agency, it need not advise the State agency of subsequent contracts. The Contractor may advise the State agency when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, American Samoa, Guam, the Virgin Islands of the United States, and Wake Island.

(e) Postings. (1) The Contractor shall post employment notices in conspicuous places that are available to employees and applicants for employment.

(2) The employment notices shall--

(i) State the rights of applicants and employees as well as the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified employees and applicants who are special disabled veterans, veterans of the Vietnam era, and other eligible veterans; and

(ii) Be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary of Labor), and provided by or through the Contracting Officer.

(3) The Contractor shall ensure that applicants or employees who are special disabled veterans are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled veteran, or may lower the posted notice so that it can be read by a person in a wheelchair).

(4) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement, or other contract understanding, that the Contractor is bound by the terms of the Act and is committed to take affirmative action to employ, and advance in employment, qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, the Government may take appropriate actions under the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(g) Subcontracts. The Contractor shall insert the terms of this clause in all subcontracts or purchase orders of $25,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Deputy Assistant Secretary of Labor to enforce the terms, including action for noncompliance.

(End of clause)

52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;

(iii) Rates of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor, including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

(i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and

(ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of $10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written

approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997)

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, insert "None")	Identification No.
_____	_____
_____	_____
_____	_____

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor

of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (AUG 2003)

(a) Definitions. As used in this clause--

Priority chemical means a chemical identified by the Interagency Environmental Leadership Workgroup or, alternatively, by an agency pursuant to section 503 of Executive Order 13148 of April 21, 2000, Greening the Government through Leadership in Environmental Management.

“Toxic chemical means a chemical or chemical category listed in 40 CFR 372.65.”

(b) Executive Order 13148 requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(c) The Contractor shall provide all information needed by the Federal facility to comply with the following:

(1) The emergency planning reporting requirements of section 302 of EPCRA.

(2) The emergency notice requirements of section 304 of EPCRA.

(3) The list of Material Safety Data Sheets, required by section 311 of EPCRA.

(4) The emergency and hazardous chemical inventory forms of section 312 of EPCRA.

(5) The toxic chemical release inventory of section 313 of EPCRA, which includes the reduction and recycling information required by section 6607 of PPA.

(6) The toxic chemical, priority chemical, and hazardous substance release and use reduction goals of sections 502 and 503 of Executive Order 13148.

(End of clause)

52.223-6 DRUG-FREE WORKPLACE (MAY 2001)

(a) Definitions. As used in this clause --

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to deter- mine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession, or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall-- within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) though (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor-owned or -operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(i) Major group code 10 (except 1011, 1081, and 1094.

(ii) Major group code 12 (except 1241).

(iii) Major group codes 20 through 39.

(iv) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(v) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.)), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

(5) The facility is not located in the United States or its outlying areas.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed $100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding $100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

52.225-11 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JAN 2005)

(a) Definitions. As used in this clause--

Caribbean Basin country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a Caribbean Basin country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a Caribbean Basin country into a new and different construction material distinct from the materials from which it was transformed.

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

Designated country means any of the following countries:

(1) A World Trade Organization Government Procurement Agreement country (Aruba, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea (Republic of), Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, or United Kingdom);

(2) A Free Trade Agreement country (Australia, Canada, Chile, Mexico, Morocco, or Singapore);

(3) A least developed country (Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, East Timor, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Laos, Lesotho, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Nepal, Niger, Rwanda, Samoa, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Tanzania, Togo, Tuvalu, Uganda, Vanuatu, Yemen, or Zambia); or

(4) A Caribbean Basin country (Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, or Trinidad and Tobago).

Designated country construction material means a construction material that is a WTO GPA country construction material, an FTA country construction material, a least developed country construction material, or a Caribbean Basin country construction material.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

Least developed country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a least developed country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a least developed country into a new and different construction material distinct from the materials from which it was transformed.

United States means the 50 States, the District of Columbia, and outlying areas.

WTO GPA country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a WTO GPA country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a WTO GPA country into a new and different construction material distinct from the materials from which it was transformed.

(b) Construction materials. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the WTO GPA and Free Trade Agreements (FTAs) apply to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country construction materials.

(2) The Contractor shall use only domestic, designated country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to the construction materials or components listed by the Government as follows: (Contracting Officer to list applicable excepted materials or indicate “none”)

(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) \1\
Item 1:			
Foreign construction material....	.....	.....	.....
Domestic construction material...	.....	.....	.....
Item 2:			
Foreign construction material....	.....	.....	.....
Domestic construction material...	.....	.....	.....

\1\ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free

entry certificate is issued).
List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.
Include other applicable supporting information.

(End of clause)

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (MAR 2005)

(a) Except as authorized by the Office of Foreign Assets Control (OFAC) in the Department of the Treasury, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services if any proclamation, Executive order, or statute administered by OFAC, or if OFAC's implementing regulations at 31 CFR chapter V, would prohibit such a transaction by a person subject to the jurisdiction of the United States.

(b) Except as authorized by OFAC, most transactions involving Cuba, Iran, Libya, and Sudan are prohibited, as are most imports from North Korea, into the United States or its outlying areas. Lists of entities and individuals subject to economic sanctions are included in OFAC's List of Specially Designated Nationals and Blocked Persons at TerList1.html. More information about these restrictions, as well as updates, is available in the OFAC's regulations at 31 CFR chapter V and/or on OFAC's Web site at http://epls.arnet.gov/News.html.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (JUN 2000)

(a) Definitions. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any ``Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutea not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1542(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(b) The Contractor shall use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW., MS 2626-MIB, Washington, DC 20240-4000.

The BIA will determine the eligibility and notify the Contracting Officer. No incentive payment will be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract.

(ii) The target cost of a cost-plus-incentive-fee prime contract.

(iii) The target cost and ceiling price of a fixed-price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the adjustment to the prime contract is 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(c) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer will seek funding in accordance with agency procedures.

(End of clause)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold (however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.)

(End of clause)

52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(4) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at (FAR) 2.101.to exceed the dollar amount set forth in 13.000 of the Federal Acquisition Regulation (FAR).

(End of clause)

52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government.

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

(End of clause)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS. (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) “Irrevocable letter of credit” (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of--

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of less than $25 million in the past year, ILCs over $5 million must be confirmed by another acceptable financial institution that had letter of credit business of less than $25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

_____

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

IRREVOCABLE LETTER OF CREDIT NO. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____(for reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States $_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

_____
[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. $_____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

_____

[City, State]

(Date) _____

[Name and address of financial institution]

Pay to the order of _____ [Beneficiary Agency] _____ the sum of United States $_____. This draft is drawn under Irrevocable Letter of Credit No. _____.

_____

[Beneficiary Agency]

By: _____

(End of clause)

52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (JUL 2000)-

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is $100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

INFORMATION REGARDING PERFORMANCE AND PAYMENT BONDS (FAR 28.102) (52.228-4001) FEB 2001

Within 10 days after the prescribed forms are presented to the bidder to whom award is made, unless a shorter time is prescribed in the contract, two bonds, namely a performance bond (Standard Form 25) and a payment bond (Standard Form 25A), shall be executed and furnished to the Government, each with good and sufficient surety or sureties acceptable to the Government. The penal sums of such bonds shall be as follows:

(1) Performance Bond. The penal sum of the performance bond shall equal one hundred percent (100%) of the contract price.
(2) Payment Bond. The penal sum of the payment bond shall equal one hundred percent (100%) of the contract price.

Any bonds furnished must be furnished by the Contractor to the Government prior to commencement of contract performance.

INDIVIDUAL SURETIES (52.228-4003) DEC 1999

As prescribed in FAR 28.203, individual sureties are acceptable for all types of bonds except position schedule bonds.

One individual surety is adequate support for a bond, provided the unencumbered value of the assets pledged by that individual surety equal or exceed the amount of the bond. An offeror may submit up to three individual sureties for each bond, in which case the pledged assets, when combined, must equal or exceed the penal amount of the bond. Each individual surety must accept both joint and several liability to the extent of the penal amount of the bond.

An individual surety may be accepted only if a security interest in acceptable assets is provided to the Government by the individual surety. THE SECURITY INTEREST SHALL BE FURNISHED WITH THE BOND.

Acceptable assets include:

(a) Cash, or certificates of deposit, or other cash equivalents with a federally insured financial institution;
(b) United States Government securities at market value.
(c) Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety. (See FAR 28.203-2(b)(3) for list of acceptable exchanges).

(d) Real property owned in fee simple by the surety without any form of concurrent ownership, escept as provided in FAR 28.203-2(c) (3)(iii), and located within the 50 United States, its territories, or possessions. These assets will be accepted at 100% of the most current tax assessment value (exclusive of encumbrances) or 75% of the properties' unencumbered market value provided a current appraisal is furnished. (See clause entitled "Pledges of Assets").

(e) Irrevocable letters of credit (ILC) issued by a federally insured financial institution in the name of the contracting agency and which identify the agency and solicitation or contract number for which the ILC is provided.

Unacceptable assets include but are not limited to:

(a) Notes or accounts receivable;

(b) Foreign securities;

(c) Real property as follows:

(1) Real property located outside the United States, its territories, or possessions.

(2) Real property which is a principal residence of the surety.

(3) Real property owned concurrently regardless of the form of co-tenancy (including joint tenancy, tenancy by the entirety, and tenancy in common) except where all co-tenants agree to act jointly.

(4) Life estates, leasehold estates, or future interests in real property.

(d) Personal property other than that listed as acceptable assets above (e.g., jewelry, furs, antiques);

(e) Stocks and bonds of the individual surety in a controlled, affiliated, or closely held concern of the offeror/contractor;

(f) corporate assets (e.g., plant and equipment);

(g) Speculative assets (e.g., mineral rights);

(h) Letters of credit, except as provided above.

In order for the Contracting Officer to determine the acceptability of individuals proposed as sureties, all bidders/offerors who submit bonds which are executed by individual sureties shall furnish with the bonds:

(a) SF28, Affidavit of Individual Surety,

(b) Security interest provided to the Government for all pledged assets (See clause entitled "Pledge of Assets") and

(c) A current list of all other bonds (including Bid Bonds) on which each individual surety is a surety and bonds for which the individual is requesting to be a surety, together with a statement as to the percent of completion of these bonded jobs. The list will include Contract or Solicitation Numbers, the name, address and telephone number of the contracting office, the type of bond (bid, performance or payment), and the amount of each original obligation. (Note: Performance and Payment bonds must be listed separately.)

Failure to furnish this information may result in non-approval of the surety and a determination of nonresponsibility.

52.229-3 FEDERAL, STATE, AND LOCAL TAXES (APR 2003)

(a) As used in this clause--

"Contract date" means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties" means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax" means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax" means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

Local taxes includes taxes imposed by a possession or territory of the United States, Puerto Rico, or the Northern Mariana Islands, if the contract is performed wholly or partly in any of those areas.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds $250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (SEP 2002)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) All payments due to subcontractors and suppliers from previous payments received under the contract have been made, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

_____

(Name)

_____

(Title)

_____

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against
the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

52.232-16 PROGRESS PAYMENTS (APR 2003)

The Government will make progress payments to the Contractor when requested as work progresses, but not more frequently than monthly, in amounts of $2,500 or more approved by the Contracting Officer, under the following conditions:

(a) Computation of amounts. (1) Unless the Contractor requests a smaller amount, the Government will compute each progress payment as 80 percent of the Contractor's total costs incurred under this contract whether or not actually paid, plus financing payments to subcontractors (see paragraph (j) of this clause), less the sum of all previous progress payments made by the Government under this contract. The Contracting Officer will consider cost of money that would be allowable under FAR 31.205-10 as an incurred cost for progress payment purposes.

(2) The amount of financing and other payments for supplies and services purchased directly for the contract are limited to the amounts that have been paid by cash, check, or other forms of payment, or that are determined due and will be paid to subcontractors--

(i) In accordance with the terms and conditions of a subcontract or invoice; and

(ii) Ordinarily within 30 days of the submission of the Contractor's payment request to the Government.

(3) The Government will exclude accrued costs of Contractor contributions under employee pension plans until actually paid unless--

(i) The Contractor's practice is to make contributions to the retirement fund quarterly or more frequently; and

(ii) The contribution does not remain unpaid 30 days after the end of the applicable quarter or shorter payment period (any contribution remaining unpaid shall be excluded from the Contractor's total costs for progress payments until paid).

(4) The Contractor shall not include the following in total costs for progress payment purposes in paragraph (a)(1) of this clause:

(i) Costs that are not reasonable, allocable to this contract, and consistent with sound and generally accepted accounting principles and practices.

(ii) Costs incurred by subcontractors or suppliers.

(iii) Costs ordinarily capitalized and subject to depreciation or amortization except for the properly depreciated or amortized portion of such costs.

(iv) Payments made or amounts payable to subcontractors or suppliers, except for --

(A) Completed work, including partial deliveries, to which the Contractor has acquired title; and

(B) Work under cost-reimbursement or time-and-material subcontracts to which the Contractor has acquired title.

(5) The amount of unliquidated progress payments may exceed neither (i) the progress payments made against incomplete work (including allowable unliquidated progress payments to subcontractors) nor

(ii) the value, for progress payment purposes, of the incomplete work. Incomplete work shall be considered to be the supplies and services required by this contract, for which delivery and invoicing by the Contractor and acceptance by the Government are incomplete.

(6) The total amount of progress payments shall not exceed 80 percent of the total contract price.

(7) If a progress payment or the unliquidated progress payments exceed the amounts permitted by subparagraphs (a)(4) or (a)(5) of this clause, the Contractor shall repay the amount of such excess to the Government on demand.

(8) Notwithstanding any other terms of the contract, the Contractor agrees not to request progress payments in dollar amounts of less than $2,500. The Contracting Officer may make exceptions.

(b) Liquidation. Except as provided in the Termination for Convenience of the Government clause, all progress payments shall be liquidated by deducting from any payment under this contract, other than advance or progress payments, the unliquidated progress payments, or 80 percent of the amount invoiced, whichever is less. The Contractor shall repay to the Government any amounts required by a retroactive price reduction, after computing liquidations and payments on past invoices at the reduced prices and adjusting the unliquidated progress payments accordingly. The Government reserves the right to unilaterally change from the ordinary liquidation rate to an alternate rate when deemed appropriate for proper contract financing.

(c) Reduction or suspension. The Contracting Officer may reduce or suspend progress payments, increase the rate of liquidation, or take a combination of these actions, after finding on substantial evidence any of the following conditions:

(1) The Contractor failed to comply with any material requirement of this contract (which includes paragraphs (f) and (g) of this clause).

(2) Performance of this contract is endangered by the Contractor's --

(i) Failure to make progress or

(ii) Unsatisfactory financial condition.

(3) Inventory allocated to this contract substantially exceeds reasonable requirements.

(4) The Contractor is delinquent in payment of the costs of performing this contract in the ordinary course of business.

(5) The unliquidated progress payments exceed the fair value of the work accomplished on the undelivered portion of this contract.

(6) The Contractor is realizing less profit than that reflected in the establishment of any alternate liquidation rate in paragraph (b) of this clause, and that rate is less than the progress payment rate stated in subparagraph (a)(1) of this clause.

(d) Title.

(1) Title to the property described in this paragraph (d) shall vest in the Government. Vestiture shall be immediately upon the date of this contract, for property acquired or produced before that date. Otherwise, vestiture shall occur when the property is or should have been allocable or properly chargeable to this contract.

(2) "Property," as used in this clause, includes all of the below-described items acquired or produced by the Contractor that are or should be allocable or properly chargeable to this contract under sound and generally accepted accounting principles and practices.

(i) Parts, materials, inventories, and work in process;

(ii) Special tooling and special test equipment to which the Government is to acquire title under any other clause of this contract;

(iii) Nondurable (i.e., noncapital) tools, jigs, dies, fixtures, molds, patterns, taps, gauges, test equipment, and other similar manufacturing aids, title to which would not be obtained as special tooling under paragraph (d) (2)(ii) of this clause; and

(iv) Drawings and technical data, to the extent the Contractor or subcontractors are required to deliver them to the Government by other clauses of this contract.

(3) Although title to property is in the Government under this clause, other applicable clauses of this contract; e.g., the termination or special tooling clauses, shall determine the handling and disposition of the property.

(4) The Contractor may sell any scrap resulting from production under this contract without requesting the Contracting Officer's approval, but the proceeds shall be credited against the costs of performance.

(5) To acquire for its own use or dispose of property to which title is vested in the Government under this clause, the Contractor must obtain the Contracting Officer's advance approval of the action and the terms. The Contractor shall (i) exclude the allocable costs of the property from the costs of contract performance, and (ii) repay to the Government any amount of unliquidated progress payments allocable to the property. Repayment may be by cash or credit memorandum.

(6) When the Contractor completes all of the obligations under this contract, including liquidation of all progress payments, title shall vest in the Contractor for all property (or the proceeds thereof) not--

(i) Delivered to, and accepted by, the Government under this contract; or

(ii) Incorporated in supplies delivered to, and accepted by, the Government under this contract and to which title is vested in the Government under this clause.

(7) The terms of this contract concerning liability for Government-furnished property shall not apply to property to which the Government acquired title solely under this clause.

(e) Risk of loss. Before delivery to and acceptance by the Government, the Contractor shall bear the risk of loss for property, the title to which vests in the Government under this clause, except to the extent the Government expressly assumes the risk. The Contractor shall repay the Government an amount equal to the unliquidated progress payments that are based on costs allocable to property that is damaged, lost, stolen, or destroyed.

(f) Control of costs and property. The Contractor shall maintain an accounting system and controls adequate for the proper administration of this clause.

(g) Reports and access to records. The Contractor shall promptly furnish reports, certificates, financial statements, and other pertinent information reasonably requested by the Contracting Officer for the administration of this clause. Also, the Contractor shall give the Government reasonable opportunity to examine and verify the Contractor's books, records, and accounts.

(h) Special terms regarding default. If this contract is terminated under the Default clause, (i) the Contractor shall, on demand, repay to the Government the amount of unliquidated progress payments and (ii) title shall vest in the Contractor, on full liquidation of progress payments, for all property for which the Government elects not to require delivery under the Default clause. The Government shall be liable for no payment except as provided by the Default clause.

(i) Reservations of rights.

(1) No payment or vesting of title under this clause shall --

(i) Excuse the Contractor from performance of obligations under this contract or

(ii) Constitute a waiver of any of the rights or remedies of the parties under the contract.

(2) The Government's rights and remedies under this clause

(i) Shall not be exclusive but rather shall be in addition to any other rights and remedies provided by law or this contract and

(ii) Shall not be affected by delayed, partial, or omitted exercise of any right, remedy, power, or privilege, nor shall such exercise or any single exercise preclude or impair any further exercise under this clause or the exercise of any other right, power, or privilege of the Government.

(j) Financing payments to subcontractors. The financing payments to subcontractors mentioned in paragraphs (a)(1) and (a)(2) of this clause shall be all financing payments to subcontractors or divisions, if the following conditions are met:

(1) The amounts included are limited to--

(i) The unliquidated remainder of financing payments made; plus

(ii) Any unpaid subcontractor requests for financing payments.

(2) The subcontract or interdivisional order is expected to involve a minimum of approximately 6 months between the beginning of work and the first delivery; or, if the subcontractor is a small business concern, 4 months.

(3) If the financing payments are in the form of progress payments, the terms of the subcontract or interdivisional order concerning progress payments--

(i) Are substantially similar to the terms of this clause for any subcontractor that is a large business concern, or this clause with its Alternate I for any subcontractor that is a small business concern;

(ii) Are at least as favorable to the Government as the terms of this clause;

(iii) Are not more favorable to the subcontractor or division than the terms of this clause are to the Contractor;

(iv) Are in conformance with the requirements of FAR 32.504(e); and

(v) Subordinate all subcontractor rights concerning property to which the Government has title under the subcontract to the Government's right to require delivery of the property to the Government if--

(A) The Contractor defaults; or

(B) The subcontractor becomes bankrupt or insolvent.

(4) If the financing payments are in the form of performance-based payments, the terms of the subcontract or interdivisional order concerning payments--

(i) Are substantially similar to the Performance-Based Payments clause at FAR 52.232-32 and meet the criteria for, and definition of, performance-based payments in FAR Part 32;

(ii) Are in conformance with the requirements of FAR 32.504(f); and

(iii) Subordinate all subcontractor rights concerning property to which the Government has title under the subcontract to the Government's right to require delivery of the property to the Government if--

(A) The Contractor defaults; or

(B) The subcontractor becomes bankrupt or insolvent.

(5) If the financing payments are in the form of commercial item financing payments, the terms of the subcontract or interdivisional order concerning payments--

(i) Are constructed in accordance with FAR 32.206(c) and included in a subcontract for a commercial item purchase that meets the definition and standards for acquisition of commercial items in FAR Parts 2 and 12;

(ii) Are in conformance with the requirements of FAR 32.504(g); and

(iii) Subordinate all subcontractor rights concerning property to which the Government has title under the subcontract to the Government's right to require delivery of the property to the Government if--

(A) The Contractor defaults; or

(B) The subcontractor becomes bankrupt or insolvent.

(6) If financing is in the form of progress payments, the progress payment rate in the subcontract is the customary rate used by the contracting agency, depending on whether the subcontractor is or is not a small business concern.

(7) Concerning any proceeds received by the Government for property to which title has vested in the Government under the subcontract terms, the parties agree that the proceeds shall be applied to reducing any unliquidated financing payments by the Government to the Contractor under this contract.

(8) If no unliquidated financing payments to the Contractor remain, but there are unliquidated financing payments that the Contractor has made to any subcontractor, the Contractor shall be subrogated to all the rights the Government obtained through the terms required by this clause to be in any subcontract, as if all such rights had been assigned and transferred to the Contractor.

(9) To facilitate small business participation in subcontracting under this contract, the Contractor shall provide financing payments to small business concerns, in conformity with the standards for customary contract financing payments stated in Subpart 32.113. The Contractor shall not consider the need for such financing payments as a handicap or adverse factor in the award of subcontracts.

(k) Limitations on undefinitized contract actions. Notwithstanding any other progress payment provisions in this contract, progress payments may not exceed 80 percent of costs incurred on work accomplished under undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the

scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes. This limitation shall apply to the costs incurred, as computed in accordance with paragraph (a) of this clause, and shall remain in effect until the contract action is definitized. Costs incurred which are subject to this limitation shall be segregated on Contractor progress payment requests and invoices from those costs eligible for higher progress payment rates. For purposes of progress payment liquidation, as described in paragraph (b) of this clause, progress payments for undefinitized contract actions shall be liquidated at 80 percent of the amount invoiced for work performed under the undefinitized contract action as long as the contract action remains undefinitized. The amount of unliquidated progress payments for undefinitized contract actions shall not exceed 80 percent of the maximum liability of the Government under the undefinitized contract action or such lower limit specified elsewhere in the contract. Separate limits may be specified for separate actions.

(l) Due date. The designated payment office will make progress payments on the _____ (Contracting Officer insert date as prescribed by agency head; if not prescribed, insert “30th”) day after the designated billing office receives a proper progress payment request. In the event that the Government requires an audit or other review of a specific progress payment request to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the specified due date. Progress payments are considered contract financing and are not subject to the interest penalty provisions of the Prompt Payment Act.

(m) Progress payments under indefinite--delivery contracts. The Contractor shall account for and submit progress payment requests under individual orders as if the order constituted a separate contract, unless otherwise specified in this contract.

(End of clause)

52.232-17 INTEREST (JUNE 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid. reproduce, prepare derivative works, distribute copies to the public, and (b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (OCT 2003)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project.

(A) The due date for making such payments is 14 days after the designated billing office receives a proper payment request. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date is the 14th day after the date of the Contractor's payment request, provided the designated billing office receives a proper payment request and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, is as specified in the contract or, if not specified, 30 days after approval by the Contracting Officer for release to the Contractor.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the

Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments is the later of the following two events:

(1) The 30th day after the designated billing office receives a proper invoice from the Contractor.

(2) The 30th day after Government acceptance of the work or services completed by the Contractor. For a final invoice when the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance is deemed to occur on the effective date of the contract settlement.

(B) If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(xi) of this clause. If the invoice does not comply with these requirements, the designated billing office must return it within 7 days after receipt, with the reasons why it is not a proper invoice. When computing any interest penalty owed the Contractor, the Government will take into account if the Government notifies the Contractor of an improper invoice in an untimely manner.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., discount for prompt payment terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232-38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(xi) Any other information or documentation required by the contract.

(3) Interest penalty. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval is deemed to occur constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. If actual acceptance or approval occurs within the constructive acceptance or approval period, the Government will base the determination of an interest penalty on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes, and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(5) Discounts for prompt payment. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(6) Additional interest penalty. (i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if--

(A) The Government owes an interest penalty of $1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible--

(1) The designated payment office that receives the demand will annotate it with the date of receipt provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(b) Contract financing payments. If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to use:

(i) Include a payment clause and an interest penalty clause conforming to the standards set forth in paragraphs (c)(1) and (c)(2) of this clause in each of its subcontracts; and

(ii) Require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) The Contractor furnishes to the Contracting Officer a copy of any notice issued by a Contractor pursuant to paragraph (d)(3)(i) of this clause.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to paragraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph
(e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under paragraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under paragraph (e)(5)(i) of this clause.

(f) Third-party deficiency reports--(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a “second-tier subcontractor”) a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under paragraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts DisputesAct of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. The Contractor shall issue a written notice of any withholding to a subcontractor (with a copy furnished to the Contracting Officer), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the Government is a party. The Government may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the Government for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(l) Overpayments. If the Contractor becomes aware of a duplicate contract financing or invoice payment or that the Government has otherwise overpaid on a contract financing or invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

(End of clause)

52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER—CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of this clause. As used in this clause, the term “EFT” refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either--

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (d) of this clause).

(b) Contractor's EFT information. The Government shall make payment to the Contractor using the EFT information contained in the Central Contractor Registration (CCR) database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect, then the Government need not make payment to the Contractor under this contract until correct EFT information is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for

the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government used the Contractor's EFT information incorrectly, the Government remains responsible for--

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (d) of this clause shall apply.

(f) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(g) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee shall register separately in the CCR database and shall be paid by EFT in accordance with the terms of this clause. Notwithstanding any other requirement of this contract, payment to an ultimate recipient other than the Contractor, or a financial institution properly recognized under an assignment of claims pursuant to subpart 32.8, is not permitted. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(h) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(i) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of Clause)

52.233-1 DISPUTES. (JUL 2002)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) Claim, as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding $100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) The contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of $100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over $100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative disput resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

52.233-3 PROTEST AFTER AWARD (AUG. 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect

this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

52.233-4 APPLICABLE LAW FOR BREACH OF CONTRACT CLAIM (OCT 2004)

United States law will apply to resolve any claim of breach of this contract.

(End of clause)

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

(1) conditions bearing upon transportation, disposal, handling, and storage of materials;

(2) the availability of labor, water, electric power, and roads;

(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;

(4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in

performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools,

scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

52.236-13 ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will

(1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;

(2) avoid interruptions of Government operations and delays in project completion dates; and

(3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall-

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(5) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing

outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without

such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, exc ept that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract. (c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

(1) In the specifications (including drawings and designs);

(2) In the method or manner of performance of the work;

(3) In the Government-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

(1) the date, circumstances, and source of the order and

(2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.
(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(End of clause)

52.247-64 PREFERENCE FOR PRIVATELY OWNED U.S. - FLAG COMMERCIAL VESSELS (APR 2003)

(a) Except as provided in paragraph (e) of this clause, the Cargo Preference Act of 1954 (46 U.S.C. Appx 1241(b)) requires that Federal departments and agencies shall transport in privately owned U.S.-flag commercial vessels at least 50 percent of the gross tonnage of equipment, materials, or commodities that may be transported in ocean vessels (computed separately for dry bulk carriers, dry cargo liners, and tankers). Such transportation shall be accomplished when any equipment, materials, or commodities, located within or outside the United States, that may be transported by ocean vessel are--

(1) Acquired for a U.S. Government agency account;

(2) Furnished to, or for the account of, any foreign nation without provision for reimbursement;

(3) Furnished for the account of a foreign nation in connection with which the United States advances funds or credits, or guarantees the convertibility of foreign currencies; or

(4) Acquired with advance of funds, loans, or guaranties made by or on behalf of the United States.

(b) The Contractor shall use privately owned U.S.-flag commercial vessels to ship at least 50 percent of the gross tonnage involved under this contract (computed separately for dry bulk carriers, dry cargo liners, and tankers) whenever shipping any equipment, materials, or commodities under the conditions set forth in paragraph (a) above, to the extent that such vessels are available at rates that are fair and reasonable for privately owned U.S.-flag commercial vessels.

(c)(1) The Contractor shall submit one legible copy of a rated on-board ocean bill of lading for each shipment to both (i) the Contracting Officer, and (ii) the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590. Subcontractor bills of lading shall be submitted through the Prime Contractor.

(2) The Contractor shall furnish these bill of lading copies (i) within 20 working days of the date of loading for shipments originating in the United States, or (ii) within 30 working days for shipments originating outside the United States. Each bill of lading copy shall contain the following information:

(A) Sponsoring U.S. Government agency.

(B) Name of vessel.

(C) Vessel flag of registry.

(D) Date of loading.

(E) Port of loading.

(F) Port of final discharge.

(G) Description of commodity.

(H) Gross weight in pounds and cubic feet if available.

(I) Total ocean freight revenue in U.S. dollars.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in all subcontracts or purchase orders under this contract, except those described in paragraph (e)(4).

(e) The requirement in paragraph (a) does not apply to--

(1) Cargoes carried in vessels of the Panama Canal Commission or as required or authorized by law or treaty;

(2) Ocean transportation between foreign countries of supplies purchased with foreign currencies made available, or derived from funds that are made available, under the Foreign Assistance Act of 1961 (22 U.S.C. 2353);

(3) Shipments of classified supplies when the classification prohibits the use of non-Government vessels, and

(4) Subcontracts or purchase orders for the acquisition of commercial items unless--

(i) This contract is --

(A) A contract or agreement for ocean transportation services; or

(B) A construction contract; or

(ii) The supplies being transported are--

(A) Items the Contractor is reselling or distributing to the Government without adding value. (Generally, the Contractor does not add value to the items when it subcontracts items for f.o.b. destination shipment); or

(B) Shipped in direct support of U.S. military--

(1) Contingency operations;

(2) Exercises; or

(3) Forces deployed in connection with United Nations or North Atlantic Treaty Organization humanitarian or peacekeeping operations.

(f) Guidance regarding fair and reasonable rates for privately owned U.S.-flag commercial vessels may be obtained from the Division of National Cargo, Office of Costs and Rates, Maritime Administration, 400 Seventh Street, SW, Washington, DC 20590, Phone: 202-366-4610.

(End of clause)

52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and

(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

(i) In deliverable end item quantities only; or

(ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for

(i) the affected portions of the existing contract requirement and

(ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A prediction of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action.

(1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within

the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

(i) 45 percent for fixed-price contracts or

(ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or $100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of $50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-- Construction clause of contract . . . . . , shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the

Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations." If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (MAY 2004) - ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made

by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 49.001 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (g) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Govemment may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

(i) acts of God or of the public enemy,

(ii) acts of the Government in either its sovereign or contractual capacity,

(iii) acts of another Contractor in the performance of a contract with the Government,

(iv) fires,

(v) floods,

(vi) epidemics,

(vii) quarantine restrictions,

(viii) strikes,

(ix) freight embargoes,

(x) unusually severe weather, or delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(6) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) "Definition. Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (DEC 2004)

(a) Definitions. As used in this clause—

(1) “Arising out of a contract with the DoD” means any act in connection with—

(i) Attempting to obtain;

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--

(1) In a management or supervisory capacity on this contract;

(2) On the board of directors of the Contractor;

(3) As a consultant, agent, or representative for the Contractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of the Contractor with regard to this contract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 provides that the Contractor shall be subject to a criminal penalty of not more than $500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as—

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify—

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (301) 809-4904.

(End of clause)

252.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(7) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

252.204-7000 DISCLOSURE OF INFORMATION (DEC 1991)

(a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless--

(1) The Contracting Officer has given prior written approval; or

(2) The information is otherwise in the public domain before the date of release.

(b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.

(c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

(End of clause)

252.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the contractor.

(End of clause)

252.204-7004 CENTRAL CONTRACTOR REGISTRATION (52.204-7) ALTERNATE A (NOV 2003)

(a) Definitions. As used in this clause--

“Central Contractor Registration (CCR) database” means the primary Government repository for contractor information required for the conduct of business with the Government.

“Commercial and Government Entity (CAGE) code” means--

(1) A code assigned by the Defense Logistics Information Service (DLIS) to identify a commercial or Government entity; or

(2) A code assigned by a member of the North Atlantic Treaty Organization that DLIS records and maintains in the CAGE master file. This type of code is known as an “NCAGE code.”

“Data Universal Numbering System (DUNS) number” means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

“Data Universal Numbering System +4 (DUNS+4) number” means the DUNS number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see Subpart 32.11 of the Federal Acquisition Regulation) for the same parent concern.

“Registered in the CCR database” means that--

(1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database;

(2) The Contractor's CAGE code is in the CCR database; and

(3) The Government has validated all mandatory data fields and has marked the records “Active.”

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" or "DUNS +4" followed by the DUNS or DUNS +4 number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number-

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company Physical Street Address, City, State, and Zip Code.

(iv) Company Mailing Address, City, State and Zip Code (if separate from physical).

(v) Company Telephone Number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)
(1)
(i) If a Contractor has legally changed its business name, "doing business as" name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the CCR database; (B) comply with the requirements of Subpart 42.12 of the FAR; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-

name agreement, the CCR information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the "Suspension of Payment" paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the "Suspension of payment" paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at http://www.ccr.gov or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

252.205-7000 PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991)

(a) Definition.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450 (c))); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e))) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 2004)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries subject

to this provision include: Cuba, Iran, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclosure such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

252.209-7004 SUBCONTRACTING WITH FIRMS THAT ARE OWNED OR CONTROLLED BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) Unless the Government determines that there is a compelling reason to do so, the Contractor shall not enter into any subcontract in excess of $25,000 with a firm, or subsidiary of a firm, that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country.

(b) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country. The notice must include the name of the proposed subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(End of clause)

252.215-7000 PRICING ADJUSTMENTS (DEC 1991)

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data - Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

252.219-7003 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (APR. 1996)

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions. Historically black colleges and universities,* as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

Minority institutions, as used in this clause, means institutions meeting the requirements of section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term *small disadvantaged business,* when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

252.223-7004 DRUG-FREE WORK FORCE (SEP 1988)

(a) Definitions.

(1) "Employee in a sensitive position," as used in this clause, means an employee who has been granted access to classified information; or employees in other positions that the Contractor determines involve national security; health or safety, or functions other than the foregoing requiring a high degree of trust and confidence.

(2) "Illegal drugs," as used in this clause, means controlled substances included in Schedules I and II, as defined by section 802(6) of title 21 of the United States Code, the possession of which is unlawful under chapter 13 of that Title. The term "illegal drugs" does not mean the use of a controlled substance pursuant to a valid prescription or other uses authorized by law.

(b) The Contractor agrees to institute and maintain a program for achieving the objective of a drug-free work force. While this clause defines criteria for such a program, contractors are encouraged to implement alternative approaches comparable to the criteria in paragraph (c) that are designed to achieve the objectives of this clause.

(c) Contractor programs shall include the following, or appropriate alternatives:

(1) Employee assistance programs emphasizing high level direction, education, counseling, rehabilitation, and coordination with available community resources;

(2) Supervisory training to assist in identifying and addressing illegal drug use by Contractor employees;

(3) Provision for self-referrals as well as supervisory referrals to treatment with maximum respect for individual confidentiality consistent with safety and security issues;

(4) Provision for identifying illegal drug users, including testing on a controlled and carefully monitored basis. Employee drug testing programs shall be established taking account of the following:

(i) The Contractor shall establish a program that provides for testing for the use of illegal drugs by employees in sensitive positions. The extent of and criteria for such testing shall be determined by the Contractor based on considerations that include the nature of the work being performed under the contract, the employee's duties, and efficient use of Contractor resources, and the risks to health, safety, or national security that could result from the failure of an employee adequately to discharge his or her position.

(ii) In addition, the Contractor may establish a program for employee drug testing--

(A) When there is a reasonable suspicion that an employee uses illegal drugs; or

(B) When an employees has been involved in an accident or unsafe practice;

(C) As part of or as a follow-up to counseling or rehabilitation for illegal drug use;

(D) As part of a voluntary employee drug testing program.

(iii) The Contractor may establish a program to test applicants for employment for illegal drug use.

(iv) For the purpose of administering this clause, testing for illegal drugs may be limited to those substances for which testing is prescribed by section 2..1 of subpart B of the "Mandatory Guidelines for Federal Workplace Drug Testing Programs" (53 FR 11980 (April 11, 1988), issued by the Department of Health and Human Services.

(d) Contractors shall adopt appropriate personnel procedures to deal with employees who are found to be using drugs illegally. Contractors shall not allow any employee to remain on duty or perform in a sensitive position who is found to use illegal drugs until such times as the Contractor, in accordance with procedures established by the Contractor, determines that the employee may perform in such a position.

(e) The provisions of this clause pertaining to drug testing program shall not apply to the extent that are inconsistent with state or local law, or with an existing collective bargaining agreement; provided that with respect to the latter, the Contractor agrees those issues that are in conflict will be a subject of negotiation at the next collective bargaining session.

(End of clause)

252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)

(a) "Definitions".

As used in this clause --

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602) (40 CFR part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

252.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (APR 2003)

(a) Definitions. As used in this provision--

(1) Foreign person means any person (including any individual, partnership, corporation, or other form of association) other than a United States person.

(2) United States person is defined in 50 U.S.C. App. 2415(2) and means--

(i) Any United States resident or national (other than an individual resident outside the United States who is employed by other than a United States person);

(ii) Any domestic concern (including any permanent domestic establishment of any foreign concern); and

(iii) Any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern that is controlled in fact by such domestic concern.

(b) Certification. If the offeror is a foreign person, the offeror certifies, by submission of an offer, that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. 2407(a) prohibits a United States person from taking.

(End of provision)

252.226-7001 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES, AND NATIVE HAWAIIAN SMALL BUSINESS CONCERNS (SEP 2004)

(a) Definitions. As used in this clause--

Indian means--

(1) Any person who is a member of any Indian tribe, band, group, pueblo, or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c); and

(2) Any ``Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.).

Indian organization means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C. chapter 17.

Indian-owned economic enterprise means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutes not less than 51 percent of the enterprise.

Indian tribe means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

Interested party means a contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

Native Hawaiian small business concern means an entity that is --

(1) A small business concern as defined in section 3 of the Small Business Act (15 U.S.C. 632) and relevant implementing regulations; and

(2) Owned and controlled by a Native Hawaiian as defined in 25 U.S.C. 4221(9).

(b) The Contractor shall use its best efforts to give Indian organizations, Indian-owned economic enterprises, and Native Hawaiian small business concerns the maximum practicable opportunity to participate in the subcontracts it awards, to the fullest extent consistent with efficient performance of the contract.

(c) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status.

(d) In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to--

(1) For matters relating to Indian organizations or Indian-owned economic enterprises: U.S. Department of the Interior, Bureau of Indian Affairs, Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street NW, MS-2626-MIB, Washington, DC 20240-4000. The BIA will determine the eligibility and will notify the Contracting Officer.

(2) For matters relating to Native Hawaiian small business concerns: Department of Hawaiian Home Lands, PO Box 1879, Honolulu, HI 96805. The Department of Hawaiian Home Lands will determine the eligibility and will notify the Contracting Officer.

(e) No incentive payment will be made--

(1) While a challenge is pending; or

(2) If a subcontractor is determined to be an ineligible participant.

(f)(1) The Contractor, on its own behalf or on behalf of a subcontractor at any tier, may request an incentive payment in accordance with this clause.

(2) The incentive amount that may be requested is 5 percent of the estimated cost, target cost, or fixed price included in the subcontract at the time of award to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(3) In the case of a subcontract for commercial items, the Contractor may receive an incentive payment only if the subcontracted items are produced or manufactured in whole or in part by an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(4) The Contractor has the burden of proving the amount claimed and shall assert its request for an incentive payment prior to completion of contract performance.

(5) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the estimated cost, target cost, or fixed price included in the subcontract awarded to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(6) If the Contractor requests and receives an incentive payment on behalf of a subcontractor, the Contractor is obligated to pay the subcontractor the incentive amount.

(g) The Contractor shall insert the substance of this clause, including this paragraph (g), in all subcontracts exceeding $500,000.
(End of clause)

252.227-7023 DRAWINGS AND OTHER DATA TO BECOME PROPERTY OF GOVERNMENT. (MAR 1979)

All designs, drawings, specifications, notes and other works developed in the performance of this contract shall become the sole property of the Government and may be used on any other design or construction without additional compensation to the Contractor. The Government shall be considered the "person for whom the work was prepared" for the purpose of authorship in any copyrightable work under 17 U.S.C. 201(b). With respect thereto, the Contractor agrees not to assert or authorize others to assert any rights nor establish any claim under the design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish all retained works on the request of the Contracting Officer. Unless otherwise provided in this contract, the Contractor shall have the right to retain copies of all works beyond such period.

(End of clause)

252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

252.236-7000 MODIFICATION PROPOSALS - PRICE BREAKDOWN. (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown --

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for --

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

252.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation subpart 42.5.

(End of clause)

252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR part 31 and DFARS part 231, in effect on the date of this contract, apply.

252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to----

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustment under an incentive provision of the contract.

252.247-7023 Transportation of Supplies by Sea (MAY 2002)

(a) Definitions. As used in this clause --

(1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.

(2) "Department of Defense" (DoD) means the Army, Navy, Air Force, Marine Corps, and defense agencies.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.

(i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(ii) "Supplies" includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

(b)(1) The Contractor shall use U.S.-flag vessels when transporting any supplies by sea under this contract.

(2) A subcontractor transporting supplies by sea under this contract shall use U.S.-flag vessels if--

(i) This contract is a construction contract; or

(ii) The supplies being transported are--

(A) Noncommercial items; or

(B) Commercial items that--

(1) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it contracts for f.o.b. destination shipment);

(2) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(3) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(c) The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that --

(1) U.S.-flag vessels are not available for timely shipment;

(2) The freight charges are inordinately excessive or unreasonable; or

(3) Freight charges are higher than charges to private persons for transportation of like goods.

(d) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract. Requests shall contain at a minimum --

(1) Type, weight, and cube of cargo;

(2) Required shipping date;

(3) Special handling and discharge requirements;

(4) Loading and discharge points;

(5) Name of shipper and consignee;

(6) Prime contract number; and

(7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.

(e) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Maritime Administration, Office of Cargo Preference, U.S. Department of Transportation, 400 Seventh Street SW., Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information:

(1) Prime contract number;

(2) Name of vessel;

(3) Vessel flag of registry;

(4) Date of loading;

(5) Port of loading;

(6) Port of final discharge;

(7) Description of commodity;

(8) Gross weight in pounds and cubic feet if available;

(9) Total ocean freight in U.S. dollars; and

(10) Name of the steamship company.

(f) The Contractor shall provide with its final invoice under this contract a representation that to the best of its knowledge and belief--

(1) No ocean transportation was used in the performance of this contract;

(2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;

(3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format:

ITEM DESCRIPTION	CONTRACT LINE ITEMS	QUANTITY

TOTAL_____

(g) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(h) In the award of subcontracts for the types of supplies described in paragraph (b)(2) of this clause, the Contractor shall flow down the requirements of this clause as follows:

(1) The Contractor shall insert the substance of this clause, including this paragraph (h), in subcontracts that exceed the simplified acquisition threshold in part 2 of the Federal Acquisition Regulation.

(2) The Contractor shall insert the substance of paragraphs (a) through (e) of this clause, and this paragraph (h), in subcontracts that are at or below the simplified acquisition threshold in part 2 of the Federal Acquisition Regulation.

(End of clause)

252.247-7024 Notification of Transportation of Supplies by Sea (MAR 2000)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor --

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause; including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties--

(1) In all subcontracts under this contract, if this contract is a construction contract; or

(2) If this contract is not a construction contract, in all subcontracts under this contract that are for--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(End of clause)

Security Contract Language for all Corps of Engineers' Unclassified Contracts (PIL 2003-06, 19 Feb 03)

All Contractor employees (U.S. citizens and Non-U.S. citizens) working under this contract (*to include grants, cooperative agreements and task orders*) who require access to Automated Information Systems (AIS), (stand alone computers, network computers/systems, e-mail) shall, at a minimum, be designated into an ADP-III position (non-sensitive) in accordance with DoD 5220-22-R, Industrial Security Regulation. The investigative requirements for an ADP-III position are a favorable National Agency Check (NAC), SF-85P, Public Trust Position. The contractor shall have each applicable employee complete a SF-85P and submit to the Seattle District, U.S. Army, Corps of Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Officer within three (3) working days after award of any contract or task order, and shall be submitted prior to the individual being permitted access to an AIS. Contractors that have a commercial or government entity (CAGE) Code and Facility Security Clearance through the Defense Security Service shall process the NACs and forward visit requests/results of NAC to the Seattle District, U.S. Army, Corps of

Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Officer. For those contractors that do not have a CAGE Code or Facility Security Clearance, the Seattle District, U.S. Army, Corps of Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Office will process the investigation in coordination with the Contractor and contract employees.

In accordance with Engineering Regulation, ER 380-1-18, Section 4, foreign nationals who work on Corps of Engineers' contracts or task orders shall be approved by the HQUSACE Foreign Disclosure Officer or higher before beginning work on the contract/task order. This regulation includes subcontractor employees. (NOTE: exceptions to the above requirement include foreign nationals who perform janitorial and/or ground maintenance services.) The contractor shall submit to the Division/District Contract Office, the names of all foreign nationals proposed for performance under this contract/task order, along with documentation to verify that he/she was legally admitted into the United States and has authority to work and/or go to school in the US. Such documentation may include a US passport, Certificate of US citizenship (INS Form N-560 or N-561), Certificate of Naturalization (INS Form N-550 or N-570), foreign passport with I-551 stamp or attached INS Form I-94 indicating employment authorization, Alien Registration Receipt Card with photograph (INS Form I-151 or I-551), Temporary Resident Card (INS Form I-688), Employment Authorization Card (INS Form I-688A), Reentry Permit (INS Form I-327), Refugee Travel Document (INS Form I-571), Employment Authorization Document issued by the INS which contains a photograph (INS Form I-688B).

Classified contracts require the issuance of a DD Form 254 (Department of Defense Contract Security Classification Specification).

(End of Clause)

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SPECIAL CLAUSES

SC-1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) (FAR 52.211-10):

The contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 540 calendar days after date of receipt by Contractor of notice to proceed. The time stated for completion shall include final cleanup of the premises.

SC-1.1. OPTION FOR INCREASED QUANTITY:

a. The Government may increase the quantity of work awarded by exercising one or more of the Optional Bid Item(s) 0005 through 0011 at any time, or not at all, but no later than 60 calendar days after receipt by Contractor of notice to proceed. Notice to proceed on work Item(s) added by exercise of the option(s) will be given upon execution of consent of surety.

b. The parties hereto further agree that any option herein shall be considered to have been exercised at the time the Government deposits written notification to the Contractor in the mail.

c. The time allowed for completion of any optional items awarded under this contract will be the same as that for the base item(s), and will be measured from the date of receipt of the notice to proceed for the base item(s).

SC-1.2 Exception to Completion Period(s): In case the Contracting Officer determines that completion of seeding, sodding, and planting, and establishment of same is not feasible within the completion period(s) stated above, the Contractor shall accomplish such work in the first planting period following the contract completion period and shall complete such work as specified, unless other planting periods are directed or approved by the Contracting Officer.

SC-2. LIQUIDATED DAMAGES - CONSTRUCTION (SEP 2000) (FAR 52.211-12):

(a) If the Contractor fails to complete the work within the time specified in the Contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of $2,234.00 for each day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, the resulting damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess cost of repurchase under the Termination clause of the CONTRACT CLAUSES.

(c) Exception to Liquidated Damage: In case the Contracting Officer determines that completion of work stated above in paragraph Exception to Completion Period(s) is not feasible during the completion period(s) stated in SC-1, such work will be exempted from liquidated damages.

SC-3. TIME EXTENSIONS (Sept 2000) (FAR 52.211-13):

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the Contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change order also may provide an equitable readjustment of liquidated damages under the new completion schedule.

SC-4 DELETED..

SC-5. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JAN 1997) (FAR 52.228-5):

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance period of this Contract at least the kinds and minimum amounts of insurance required in the Insurance Liability Schedule or elsewhere in the Contract.

(b) Before commencing work under this Contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective:

(1) For such period as the laws of the State in which this Contract is to be performed prescribe; or

(2) Until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this Contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the Contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

SC-5.1 REQUIRED INSURANCE IN ACCORDANCE WITH FAR 28.307-2:

(1) Workers' compensation and employer's liability: Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when Contract operations are so commingled with a Contractor's commercial operation that it would not be practical to require this coverage. Employer's liability coverage of at least $100,000 shall be required, except in states with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(2) General Liability:

(a) The Contracting Officer shall require bodily injury liability insurance coverage written on the comprehensive form of policy of at least $500,000 per occurrence.

(b) Property damage liability insurance shall be required only in special circumstances as determined by the agency.

(3) Automobile liability: The Contracting Officer shall require automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury and property damage liability covering the operation of all automobiles used in connection with performing the Contract. Policies covering automobiles operated in the United States shall provide coverage of at least $200,000 per person and $500,000 per occurrence for bodily injury and $20,000 per occurrence for property damage. The amount of liability coverage on other policies shall be commensurate with any legal requirements of the locality and sufficient to meet normal and customary claims.

(4) Aircraft public and passenger liability: When aircraft are used in connection with performing the Contract, the Contracting Officer shall require aircraft public and passenger liability insurance. Coverage shall be at least $200,000 per person and $500,000 per occurrence for bodily injury, other than passenger liability, and $200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least $200,000 multiplied by the number of seats or passengers, whichever is greater.

(5) Environmental Liability: If this contract includes the transport, treatment, storage, or disposal of hazardous material waste the following coverage is required.

The Contractor shall ensure the transporter and disposal facility have liability insurance if effect for claims arising out of the death or bodily injury and property damage from hazardous material/waste transport, treatment, storage and disposal, including vehicle liability and legal defense costs in the amount of $1,000,000.00 as evidenced by a certificate of insurance for General, Automobile, and Environmental Liability Coverage. Proof of this insurance shall be provided to the Contracting Officer.

SC-6 DELETED.

SC-7. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) (FAR 52.236-1):

The Contractor shall perform on the site, and with its own organization, work equivalent to at least fifteen percent (15%) of the total amount of work to be performed under the Contract. The percentage may be reduced by a supplemental agreement to this Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SC-8. PHYSICAL DATA (APR 1984) (FAR 52.236-4):

Data and information furnished or referred to below is for the Contractor's information. The Government will not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) Physical Conditions: The indications of physical conditions on the drawings and in the specifications are the result of site investigations by test holes shown on the drawings.

(b) Weather Conditions: Each bidder shall be satisfied before submitting his bid as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any National Weather Service Office.

(c) Transportation Facilities: Each bidder, before submitting his bid, shall make an investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the jobsite. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of the work.

SC-9 DELETED.

SC-10. LAYOUT OF WORK (APR 1984) (FAR 52.236-17):

The Contractor shall lay out its work from Government-established base lines and benchmarks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due, or to become due, to the Contractor.

SC-11. RESERVED:

SC-12 AND SC-13 DELETED.

SC-14. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)-(EFARS 52.231-5000):

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region VIII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(e) Copies of EP1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" Volumes 1 through 12 are available in Portable Document Format (PDF) and can be viewed or downloaded at http://www.usace.army.mil/inet/usace-docs/eng-pamplets/cecw.htm. A CD-ROM containing (Volumes 1-12) is available through either the Superintendent of Documents or Government bookstores. For additional information telephone 202-512-2250, or access on the Internet at http://www.access.gpo.gov/su_docs.

SC-15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAR 1995)-(EFARS 52.232-5000):

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: Any other construction material stored offsite may be considered in determining the amount of a progress payment.

SC-16 AND SC-17 DELETED.

SC-18. CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)(DOD FAR SUPP 252.236-7001):

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall:

(1) Check all drawings furnished immediately upon receipt.

(2) Compare all drawings and verify the figures before laying out the work.

(3) Promptly notify the Contracting Officer of any discrepancies.

(4) Be responsible for any errors which might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general—

(1) Large scale drawings shall govern small scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the index of drawings attached at the end of the Special Clauses.

SC-19 THROUGH SC-21 DELETED.

SC-22. EPA ENERGY STAR:

The Government requires that certain equipment be Energy Star compliant. Initially, the sole Energy Star requirement shall be the self-certification by the bidder that the specified equipment is Energy Star compliant. Within 3 months of the availability of an EPA sanctioned test for Energy Star compliance, the Contractor shall submit all equipment upgrades and additions for testing and provide proof of compliance to the Government upon completion of testing. Testing shall be at the Contractor's expense.

SC-23. RECOVERED MATERIALS:

The Corps of Engineers encourages all bidders to utilize recovered materials to the maximum extent practicable. The attached APPENDIX R contains procurement guidelines for products containing recovered materials.

SC-24 DELETED.

APPENDIX R

PART 247 - COMPREHENSIVE PROCUREMENT GUIDELINE FOR PRODUCTS CONTAINING RECOVERED MATERIALS

40 CFR Ch. 1 (9-1-99 Edition)

Subpart B-Item Designations

§ 247.10 Paper and paper products.

Paper and paper products, excluding building and construction paper grades.

§ 247.11 Vehicular products.

1. Lubricating oils containing re-refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, excluding marine and aviation oils.
2. Tires, excluding airplane tire
3. Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

247.12 Construction products.

1. Building insulation product including the following items:
2. Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock vermiculite, and perlite;
3. Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool).
4. Board (sheathing, roof decking wall panel) insulation, including but not limited to structural fiberboard and laminated paperboard products perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and
5. Spray-in-place insulation, including but not limited to foam-in-place polyurethane and polyisocyanurate and spray-on cellulose.
6. Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing shingle backer, sound deadening board, roof insulating board, insulating wallboard, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels, floor underlayments, and roof overlay (cover board).
7. Cement and concrete, including concrete products such as pipe and block, containing coal fly as ground granulated blast furnace (GGBF) slag.
8. Carpet made of polyester fiber use in low- and medium-wear applications.
9. Floor tiles and patio block containing recovered rubber or plastic.
10. Shower and restroom dividers/partitions containing recovered plastic or steel.
11. Consolidated latex paint used for covering graffiti; and
12. Reprocessed latex paint used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood and metal surfaces.

§247.13 Transportation products.

1. Traffic barricades and traffic cones used in controlling or restricting vehicular traffic.
2. Parking stops made from concrete or containing recovered plastic or rubber.

3. Channelizers containing recovered plastic or rubber.
4. Delineators containing recovered plastic, rubber, or steel.
5. Flexible delineators containing recovered plastic.

§ 247.14 Park and recreation products

1. Playground surfaces and running tracks containing recovered rubber or plastic.
2. Plastic fencing containing recovered plastic for use in controlling snow or sand drifting and as a warning/safety barrier in construction or other applications.

247.15 Landscaping products.

1. Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and as an over-spray for straw mulch in landscaping, erosion control, and soil reclamation.
2. Compost made from yard trimmings, leaves, and/or grass clippings for use in landscaping, seeding of grass or other plants on roadsides and embankments, as a nutritious mulch under trees and shrubs, and in erosion control and soil reclamation.
3. Garden and soaker hoses containing recovered plastic or rubber.
4. Lawn and garden edging containing recovered plastic or rubber.

§ 247.16 Non-paper office product.

1. Office recycling containers and office waste receptacles.
2. Plastic desktop accessories.
3. Toner cartridges.
4. Binders.
5. Plastic trash bags.
6. Printer ribbons.
7. Plastic envelops.

§ 247.17 Miscellaneous products.

Pallets containing recovered wood, plastic, or paperboard.

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FORT LEWIS, WASHINGTON
PN 44772
Drawing No. 22s/730-20-03

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13	C-502	UTILITY DETAILS 1		18 JUL 05
14	C-503	UTILITY DETAILS 2		18 JUL 05
15	C-504	UTILITY DETAILS 3		18 JUL 05
16	C-505	MISCELLANEOUS DETAILS 1		18 JUL 05
17	C-506	MISCELLANEOUS DETAILS 2		18 JUL 05
18	C-507	JOINT DETAILS		18 JUL 05
19	L-001	LANDSCAPE/IRRIGATION LEGEND & NOTES		18 JUL 05
20	L-101	LANDSCAPE PLAN 1		18 JUL 05
21	L-102	LANDSCAPE PLAN 2		18 JUL 05
22	L-103	IRRIGATION PLAN 1		18 JUL 05
23	L-104	IRRIGATION PLAN 2		18 JUL 05
24	L-501	LANDSCAPE DETAILS 1		18 JUL 05
25	L-502	LANDSCAPE DETAILS 2		18 JUL 05
26	L-503	IRRIGATION DETAILS 1		18 JUL 05
27	S-001	STRUCTURAL GENERAL NOTES I		18 JUL 05
28	S-002	STRUCTURAL GENERAL NOTES II		18 JUL 05
29	S-101	FOUNDATION PLAN		18 JUL 05
30	S-102	LOW ROOF FRAMING PLAN		18 JUL 05
31	S-103	HIGH ROOF FRAMING PLAN		18 JUL 05
32	S-104	SIPS LAYOUT PLAN		18 JUL 05
33	S-105	SHEARWALL LAYOUT PLAN		18 JUL 05
34	S-201	GLULAM ARCH FRAME		18 JUL 05
35	S-202	GLULAM ARCH FRAME GRID D		18 JUL 05

SHEET No.	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
36	S-203	GLULAM ARCH FRAME GRIDS 1 & 13		18 JUL 05
37	S-204	GLULAM ARCH FRAME GRIDS A & B		18 JUL 05
38	S-301	FRAMING SECTIONS AND ELEVATIONS		18 JUL 05
39	S-401	ENLARGED FOUNDATION PLAN A		18 JUL 05
40	S-402	ENLARGED FOUNDATION PLAN B		18 JUL 05
41	S-403	ENLARGED FOUNDATION PLAN C		18 JUL 05
42	S-404	ENLARGED FOUNDATION PLAND		18 JUL 05
43	S-501	FOUNDATION SECTIONS and DETAILS I		18 JUL 05
44	S-502	FOUNDATION SECTIONS AND DETAILS II		18 JUL 05
45	S-503	FRAMING DETAILS I		18 JUL 05
46	S-504	FRAMING DETAILS II		18 JUL 05
47	S-505	FRAMING DETAILS III		18 JUL 05
48	S-506	STEEL FRAME DETAILS I		18 JUL 05
49	S-507	STEEL FRAME DETAILS II		18 JUL 05
50	S-508	TYPICAL SLAB DETAILS		18 JUL 05
51	S-509	ROOF DETAILS I		18 JUL 05
52	S-510	ROOF DETAILS II		18 JUL 05
53	S-511	ROOF DETAILS III		18 JUL 05
54	S-512	N & S ENTRY PORTICO SECTIONS AND DETAILS		18 JUL 05
55	S-601	NAILING AND HEADER SCHEDULE		18 JUL 05
56	S-701	OPERABLE PARTITION PLAN AND DETAILS I		18 JUL 05
57	S-702	OPERABLE PARTITION PLAN AND DETAILS II		18 JUL 05
58	S-801	FREE STANDING STORAGE BLDG. PLAN & SECTION		18 JUL 05
59	A-001	ABBREVIATIONS AND NOTES		18 JUL 05
60	A-002	LIFE SAFETY SUMMARY		18 JUL 05
61	A-101	FLOOR PLANS		18 JUL 05
62	A-102	ROOF PLAN		18 JUL 05
63	A-103	REFLECTED CEILING PLAN		18 JUL 05
64	A-104	FREE STANDING STORAGE BLDG.		18 JUL 05
65	A-201	EXTERIOR ELEVATIONS I		18 JUL 05
66	A-202	INTERIOR ELEVATIONS I		18 JUL 05
67	A-203	INTERIOR ELEVATIONS II		18 JUL 05
68	A-204	INTERIOR ELEVATIONS III		18 JUL 05
69	A-205	INTERIOR ELEVATIONS IV		18 JUL 05
70	A-206	INTERIOR ELEVATIONS V		18 JUL 05
71	A-207	INTERIOR ELEVATIONS VI		18 JUL 05
72	A-208	INTERIOR ELEVATIONS VII		18 JUL 05
73	A-209	INTERIOR ELEVATIONS VIII		18 JUL 05
74	A-210	INTERIOR ELEVATIONS IX		18 JUL 05
75	A-211	INTERIOR ELEVATIONS X		18 JUL 05
76	A-301	BUILDING SECTIONS I		18 JUL 05
77	A-302	BUILDING SECTIONS II		18 JUL 05
78	A-303	CEILING SUBFRAME SECTION AND PLAN		18 JUL 05
79	A-304	WALL SECTIONS I		18 JUL 05

SHEET No.	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
80	A-305	WALL SECTIONS II		18 JUL 05
81	A-306	WALL SECTIONS III		18 JUL 05
82	A-307	WALL SECTIONS IV		18 JUL 05
83	A-308	WALL SECTIONS V		18 JUL 05
84	A-309	WALL SECTIONS VI		18 JUL 05
85	A-310	STAIR SECTIONS		18 JUL 05
86	A-401	ENLARGED FLOOR PLANS I		18 JUL 05
87	A-402	ENLARGED FLOOR PLANS II		18 JUL 05
88	A-403	ENLARGED FLOOR PLANS III		18 JUL 05
89	A-404	ENLARGED FLOOR PLANS IV		18 JUL 05
90	A-405	ENLARGED FLOOR PLANS V		18 JUL 05
91	A-406	ENLARGED FLOOR PLANS VI		18 JUL 05
92	A-407	ENLARGED FLOOR PLANS VII		18 JUL 05
93	A-408	REFLECTED CEILING PLAN I		18 JUL 05
94	A-409	REFLECTED CEILING PLAN II		18 JUL 05
95	A-410	REFLECTED CEILING PLAN III		18 JUL 05
96	A-411	REFLECTED CEILING PLAN IV		18 JUL 05
97	A-412	REFLECTED CEILING PLAN V		18 JUL 05
98	A-413	REFLECTED CEILING PLAN VI		18 JUL 05
99	A-414	REFLECTED CEILING PLAN VII		18 JUL 05
100	A-415	ENLARGED ELEVATIONS I		18 JUL 05
101	A-416	ENLARGED ELEVATIONS II		18 JUL 05
102	A-417	ENLARGED PORTICO PLANS		18 JUL 05
103	A-501	STAIR DETAILS		18 JUL 05
104	A-502	EXTERIOR DETAILS I		18 JUL 05
105	A-503	EXTERIOR DETAILS II		18 JUL 05
106	A-504	ROOF DETAILS I		18 JUL 05
107	A-505	ROOF DETAILS II		18 JUL 05
108	A-506	WALL DETAILS I		18 JUL 05
109	A-507	WALL DETALS II		18 JUL 05
110	A-508	CEILING DETAILS I		18 JUL 05
111	A-509	CEILING DETAILS II		18 JUL 05
112	A-510	DOOR DETAILS		18 JUL 05
113	A-511	WINDOW AND LOUVER DETAILS		18 JUL 05
114	A-512	WINDOW DETAILS		18 JUL 05
115	A-513	INTERIOR DETAILS		18 JUL 05
116	A-514	INTERIOR CASEWORK DETAILS I		18 JUL 05
117	A-515	INTERIOR CASEWORK DETAILS II		18 JUL 05
118	A-516	MISCELLANEOUS DETAILS I		18 JUL 05
119	A-517	MISCELLANEOUS DETAILS II		18 JUL 05
120	A-601	WALL TYPE SCHEDULE		18 JUL 05
121	A-602	ROOM FINISH SCHEDULE I		18 JUL 05
122	A-603	ROOM FINISH SCHEDULE II		18 JUL 05
123	A-604	DOOR SCHEDULE I		18 JUL 05

SHEET No.	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
124	A-605	DOOR SCHEDULE II		18 JUL 05
125	A-606	EXT. FINISH, WINDOW & LOUVER SCH		18 JUL 05
126	A-607	SIGNAGE SCHEDULE		18 JUL 05
127	I-101	FURNITURE LAYOUT I		18 JUL 05
128	I-102	FURNITURE LAYOUT II		18 JUL 05
129	I-401	ALTERNATE FURNITURE PLAN I		18 JUL 05
130	I-402	ALTERNATE FURNITURE PLAN II		18 JUL 05
131	I-403	ALTERNATE FURNITURE PLAN III		18 JUL 05
132	F-001	LEGEND AND ABBREVIATIONS		18 JUL 05
133	F-101	GROUND FLOOR SPRINKLER PLAN		18 JUL 05
134	F-102	ATTIC SPRINKLER PLAN		18 JUL 05
135	F-103	ATTIC FIRE PROTECTION PLAN		18 JUL 05
136	F-401	GROUND FLOOR FIRE PROTECTION PLAN I		18 JUL 05
137	F-402	GROUND FLOOR FIRE PROTECTION PLAN II		18 JUL 05
138	F-501	FIRE SPRINKLER DETAILS		18 JUL 05
139	F-502	FIRE ALARM DETAILS		18 JUL 05
140	F-601	FIRE ALARM RISER DIAGRAM		18 JUL 05
141	P-101	COMPOSITE FOUNDATION PLUMBING PLAN		18 JUL 05
142	P-102	COMPOSITE GROUND FLOOR PLUMBING PLAN		18 JUL 05
143	P-401	ENLARGED PLUMBING PLAN I		18 JUL 05
144	P-402	ENLARGED PLUMBING PLAN II		18 JUL 05
145	P-403	ENLARGED PLUMBING PLAN III		18 JUL 05
146	P-404	ENLARGED PLUMBING PLAN IV		18 JUL 05
147	P-405	ENLARGED PLUMBING PLAN V		18 JUL 05
148	P-406	ENLARGED PLUMBING PLAN VI		18 JUL 05
149	P-407	ENLARGED PLUMBING PLAN VII		18 JUL 05
150	P-408	ENLARGED TOILET PLUMBING PLANS		18 JUL 05
151	P-409	ENLARGED MECH PLUMBING PLANS		18 JUL 05
152	P-501	PLUMBING DETAILS I		18 JUL 05
153	P-502	PLUMBING DETAILS II		18 JUL 05
154	P-503	PLUMBING DETAILS III		18 JUL 05
155	P-601	PLUMBING SCHEDULES		18 JUL 05
156	P-901	WASTE/VENT ISOMETRIC DIAGRAM		18 JUL 05
157	P-902	DOMESTIC WATER SUPPLY ISOMETRIC DIAGRAM		18 JUL 05
158	M-001	LEGEND & ABBREVIATIONS		18 JUL 05
159	M-002	CONTROLS LEGEND		18 JUL 05
160	M-101	GROUND FLOOR HVAC PLAN		18 JUL 05
161	M-102	HYDRONIC PIPING PLAN WEST HALF		18 JUL 05
162	M-103	HYDRONIC PIPING PLAN EAST HALF		18 JUL 05
163	M-104	FOUNDATION RADIANT PLAN		18 JUL 05
164	M-301	MECH SECTIONS I		18 JUL 05
165	M-302	MECH SECTIONS II		18 JUL 05
166	M-401	ENLARGED MECHANICAL PLAN I		18 JUL 05
167	M-402	ENLARGED MECHANICAL PLAN II		18 JUL 05

SHEET No.	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
168	M-403	ENLARGED MECHANICAL PLAN III		18 JUL 05
169	M-404	ENLARGED MECHANICAL PLAN IV		18 JUL 05
170	M-405	ENLARGED MECHANICAL PLAN V		18 JUL 05
171	M-406	ENLARGED MECHANICAL PLAN VI		18 JUL 05
172	M-407	ENLARGED MECHANICAL PLAN VII		18 JUL 05
173	M-501	DETAILS I		18 JUL 05
174	M-502	DETAILS II		18 JUL 05
175	M-503	DETAILS III		18 JUL 05
176	M-504	DETAILS IV		18 JUL 05
177	M-505	DETAILS V		18 JUL 05
178	M-506	DETAILS VI		18 JUL 05
179	M-507	DETAILS VII		18 JUL 05
180	M-508	DETAILS VIII		18 JUL 05
181	M-601	MECHANICAL SCHEDULES I		18 JUL 05
182	M-602	MECHANICAL SCHEDULES II		18 JUL 05
183	M-603	MECHANICAL SCHEDULES III		18 JUL 05
184	M-604	MECHANICAL SCHEDULES IV		18 JUL 05
185	M-605	MECHANICAL SCHEDULES V		18 JUL 05
186	M-701	HEAT PUMP CONTROLS I		18 JUL 05
187	M-702	HEATING WATER CONTROLS II		18 JUL 05
188	M-703	HEATING WATER CONTROLS III		18 JUL 05
189	M-704	VAV AHU CONTROLS I		18 JUL 05
190	M-705	VAV AHU CONTROLS II		18 JUL 05
191	M-706	VAV AHU CONTROLS III		18 JUL 05
192	M-707	VAV AHU CONTROLS IV		18 JUL 05
193	M-708	VAV AHU CONTROLS V		18 JUL 05
194	E-001	LEGEND AND ABBREVIATIONS		18 JUL 05
195	E-101	SITE DEMOLITION PLAN		18 JUL 05
196	E-102	ELECTRICAL SITE PLAN		18 JUL 05
197	E-103	SITE GROUNDING PLAN		18 JUL 05
198	E-104	FREE STANDING STORAGE BUILDING		18 JUL 05
199	E-401	LIGHTING PLAN I		18 JUL 05
200	E-402	LIGHTING PLAN II		18 JUL 05
201	E-403	LIGHTING PLAN III		18 JUL 05
202	E-404	LIGHTING PLAN IV		18 JUL 05
203	E-405	LIGHTING PLAN V		18 JUL 05
204	E-406	LIGHTING PLAN VI		18 JUL 05
205	E-407	LIGHTING PLAN VII		18 JUL 05
206	E-408	POWER PLAN I		18 JUL 05
207	E-409	POWER PLAN II		18 JUL 05
208	E-410	POWER PLAN III		18 JUL 05
209	E-411	POWER PLAN IV		18 JUL 05
210	E-412	POWER PLAN V		18 JUL 05
211	E-413	POWER PLAN VI		18 JUL 05

SHEET No.	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
212	E-414	POWER PLAN VII		18 JUL 05
213	E-501	DUCTBANK DETAILS		18 JUL 05
214	E-502	MISCELLANEOUS EXTERIOR DETAILS		18 JUL 05
215	E-503	COMMUNICATIONS MANHOLE		18 JUL 05
216	E-504	POWER MANHOLE		18 JUL 05
217	E-505	TRANSFORMER DETAILS		18 JUL 05
218	E-506	LIGHTNING PROTECTION DETAILS		18 JUL 05
219	E-507	LIGHTING DETAILS 1		18 JUL 05
220	E-508	LIGHTING DETALS 2		18 JUL 05
221	E-509	LIGHTING DETAILS 3		18 JUL 05
222	E-510	LIGHTING DETAILS 4		18 JUL 05
223	E-511	LIGHTING DETAILS 5		18 JUL 05
224	E-512	LIGHTING DETAILS 6		18 JUL 05
225	E-513	LIGHTING SCHEDULE		18 JUL 05
226	E-514	SWITCHBOARD DETAILS		18 JUL 05
227	E-601	DUCTBANK SCHEDULE		18 JUL 05
228	E-602	POWER RISER DIAGRAM		18 JUL 05
229	E-603	LIGHTING CONTROL DIAGRAM		18 JUL 05
230	E-604	PANEL SCHEDULE 1		18 JUL 05
231	E-605	PANEL SCHEDULE 2		18 JUL 05
232	E-606	PANEL SCHEDULE 3		18 JUL 05
233	E-607	PANEL SCHEDULE 4		18 JUL 05
234	E-608	PANEL SCHEDULE 5		18 JUL 05
235	T-001	LEGEND AND ABBREVIATIONS		18 JUL 05
236	T-401	COMMUNICATIONS PLAN I		18 JUL 05
237	T-402	COMMUNICATIONS PLAN II		18 JUL 05
238	T-403	COMMUNICATIONS PLAN III		18 JUL 05
239	T-404	COMMUNICATIONS PLAN IV		18 JUL 05
240	T-405	COMMUNICATIONS PLAN V		18 JUL 05
241	T-406	COMMUNICATIONS PLAN VI		18 JUL 05
242	T-407	COMMUNICATIONS PLAN VII		18 JUL 05
243	T-408	ENLARGED COMM. EQUIPMENT ROOM		18 JUL 05
244	T-501	COMMUNICATIONS DETAILS 1		18 JUL 05
245	T-502	COMMUNICATIONS DETAILS 2		18 JUL 05
246	T-601	COMMUNICATIONS RISER DIAGRAMS		18 JUL 05
247	T-602	MASS NOTIFICATION DETAILS		18 JUL 05

STANDARD DETAILS BOUND IN THE SPECIFICATIONS

DRAWING NUMBER	SHEET NUMBER	TITLE	DATE

SECTION 01501 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1 & 2	U.S. Army Project Construction Sign	84JUN20
1	Hard Hat Sign	10SEP90

END OF SECTION

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General Decision Number: WA030001 07/29/2005 WA1

Superseded General Decision Number: WA020001

State: Washington

Construction Types: Heavy (Heavy, and Dredging) and Highway

Counties: Washington Statewide.

HEAVY AND HIGHWAY AND DREDGING CONSTRUCTION PROJECTS (Excludes D.O.E. Hanford Site in Benton and Franklin Counties)

Modification Number	Publication Date
0	06/13/2003
1	01/23/2004
2	02/06/2004
3	02/13/2004
4	03/05/2004
5	03/12/2004
6	04/16/2004
7	05/14/2004
8	06/18/2004
9	06/25/2004
10	07/02/2004
11	07/23/2004
12	08/06/2004
13	08/20/2004
14	09/03/2004
15	10/01/2004
16	10/15/2004
17	10/22/2004
18	11/05/2004
19	11/19/2004
20	12/03/2004
21	01/14/2005
22	02/18/2005
23	03/18/2005
24	03/25/2005
25	04/01/2005
26	04/22/2005
27	06/03/2005
28	06/10/2005
29	06/17/2005
30	07/08/2005
31	07/29/2005

CARP0001-008 06/01/2005

	Rates	Fringes
Carpenters:		
COLUMBIA RIVER AREA - ADAMS, BENTON, COLUMBIA, DOUGLAS (EAST OF THE 120TH MERIDIAN), FERRY, FRANKLIN, GRANT, OKANOGAN (EAST OF THE 120TH MERIDIAN) AND WALLA WALLA COUNTIES		
GROUP 1	$ 24.18	7.75
GROUP 2	$ 25.29	7.75
GROUP 3	$ 24.45	7.75
GROUP 4	$ 24.18	7.75

GROUP 5:.....$ 59.90 7.75
GROUP 6:.....$ 28.32 7.75
SPOKANE AREA: ASOTIN,
GARFIELD, LINCOLN, PEND
OREILLE, SPOKANE, STEVENS
AND WHITMAN COUNTIES
GROUP 1:.....$ 23.51 7.75
GROUP 2:.....$ 24.61 7.75
GROUP 3:.....$ 23.77 7.75
GROUP 4:.....$ 23.51 7.75
GROUP 5:.....$ 58.24 7.75
GROUP 6:.....$ 27.60 7.75

CARPENTERS CLASSIFICATIONS

GROUP 1: Carpenter; Burner-Welder; Rigger and Signaler; Insulators (all types), Acoustical, Drywall and Metal Studs, Metal Panels and Partitions; Floor Layer, Sander, Finisher and Astro Turf; Layout Carpenters; Form Builder; Rough Framer; Outside or Inside Finisher, including doors, windows, and jams; Sawfiler; Shingler (wood, composition) Solar, Fiberglass, Aluminum or Metal; Scaffold Erecting and Dismantling; Stationary Saw-Off Bearer; Wire, Wood and Metal Lather Applicator

GROUP 2: Millwright, machine erector

GROUP 3: Piledriver - includes driving, pulling, cutting, placing collars, setting, welding, or creosote treated material, on all piling

GROUP 4: Bridge, dock and wharf carpenters

GROUP 5: Divers

GROUP 6: Divers Tender

DEPTH PAYY FOR DIVERS:
Each foot over 50-100 feet $1.00
Each foot over 100-175 feet 2.25
Each foot over 175-250 feet 5.50

HAZMAT PROJECTS:

Anyone working on a HAZMAT job (task), where HAZMAT certification is required, shall be compensated at a premium, in addition to the classification working in as follows:

LEVEL D + $.25 per hour - This is the lowest level of protection. No respirator is used and skin protection is minimal.
LEVEL C + $.50 per hour - This level uses an air purifying respirator or additional protective clothing.

LEVEL B + $.75 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit".

LEVEL A +$1.00 per hour - This level utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line.

CARP0003-006 06/01/2005

SOUTHWEST WASHINGTON: CLARK, COWLITZ, KLICKITAT, LEWIS(Piledriver only), PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to Willapa Bay to the Pacific Ocean), SKAMANIA AND WAHKIAKUM COUNTIES and INCLUDES THE ENTIRE PENINSULA WEST OF WILLAPA BAY

SEE ZONE DESCRIPTION FOR CITIES BASE POINTS

ZONE 1:

	Rates	Fringes
Carpenters:		
CARPENTERS; ACOUSTICAL.....	$ 28.41	11.16
DIVERS TENDERS.....	$ 31.01	11.16
DIVERS.....	$ 67.18	11.16
DRYWALL.....	$ 28.41	11.16
FLOOR LAYERS & FLOOR FINISHERS (the laying of all hardwood floors nailed and mastic set, parquet and wood-type tiles, and block floors, the sanding and finishing of floors, the preparation of old and new floors when the materials mentioned above are to be installed); INSULATORS (fiberglass and similar irritating materils.....	$ 28.56	11.16
MILLWRIGHTS.....	$ 28.91	11.16
PILEDRIVERS.....	$ 28.91	11.16

DEPTH PAY:
50 TO 100 FEET $1.00 PER FOOT OVER 50 FEET
100 TO 150 FEET 1.50 PER FOOT OVER 100 FEET
150 TO 200 FEET 2.00 PER FOOT OVER 150 FEET

Zone Differential (Add up Zone 1 rates):
Zone 2 - $0.85
Zone 3 - 1.25
Zone 4 - 1.70
Zone 5 - 2.00
Zone 6 - 3.00

BASEPOINTS: ASTORIA, LONGVIEW, PORTLAND, THE DALLES, AND VANCOUVER, (NOTE: All dispatches for Washington State Counties: Cowlitz, Wahkiakum and Pacific shall be from Longview Local #1707 and mileage shall be computed from that point.)

ZONE 1: Projects located within 30 miles of the respective city hall of the above mentioned cities
ZONE 2: Projects located more than 30 miles and less than 40 miles of the respective city of the above mentioned cities
ZONE 3: Projects located more than 40 miles and less than 50 miles of the respective city of the above mentioned cities
ZONE 4: Projects located more than 50 miles and less than 60 miles of the respective city of the above mentioned cities.
ZONE 5: Projects located more than 60 miles and less than 70 miles of the respective city of the above mentioned cities
ZONE 6: Projects located more than 70 miles of the respected

city of the above mentioned cities

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* CARP0770-003 06/01/2005

	Rates	Fringes
Carpenters:		
CENTRAL WASHINGTON: CHELAN, DOUGLAS (WEST OF THE 120TH MERIDIAN), KITTITAS, OKANOGAN (WEST OF THE 120TH MERIDIAN) AND YAKIMA COUNTIES		
ACCOUSTICAL WORKERS	$ 21.71	10.45
CARPENTERS AND DRYWALL APPLICATORS	$ 21.45	10.45
CARPENTERS ON CREOSOTE MATERIAL	$ 21.55	10.45
DIVERS TENDER	$ 32.26	10.67
DIVERS	$ 72.52	10.67
INSULATION APPLICATORS	$ 21.45	10.45
MILLWRIGHT AND MACHINE ERECTORS	$ 30.40	10.45
PILEDRIVER, BRIDGE DOCK AND WHARF CARPENTERS	$ 29.40	10.45
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED MATERIAL, ALL PILING	$ 29.60	10.45
SAWFILERS, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLER, FLOOR SANDER OPERATOR AND OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS	$ 21.58	10.45

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERS

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
25-35 radius miles	$1.00/hour
35-45 radius miles	$1.15/hour
45-55 radius miles	$1.35/hour
Over 55 radius miles	$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
25-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

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* CARP0770-006 06/01/2005

	Rates	Fringes
Carpenters:		
WESTERN WASHINGTON: CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS (excludes piledrivers only), MASON, PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES		
ACOUSTICAL WORKERS	$ 29.56	10.67
BRIDGE, DOCK & WHARF CARPENTERS	$ 29.40	10.67
CARPENTERS AND DRYWALL APPLICATORS	$ 29.40	10.67
CARPENTERS ON CREOSOTE MATERIAL	$ 29.50	10.67
DIVERS TENDER	$ 32.26	10.67
DIVERS	$ 72.52	10.67
INSULATION APPLICATORS	$ 29.40	10.67
MILLWRIGHT AND MACHINE ERECTORS	$ 30.40	10.67
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED MATERIAL, ALL PILING	$ 29.60	10.67
SAWFILERS, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLER, FLOOR SANDER OPERATOR AND OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS	$ 29.53	10.67

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERS

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles

Centralia Mount Vernon Sunnyside
Chelan Pt. Townsend

Zone Pay:

0 -25 radius miles	Free
25-35 radius miles	$1.00/hour
35-45 radius miles	$1.15/hour
45-55 radius miles	$1.35/hour
Over 55 radius miles	$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
25-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

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* ELEC0046-001 06/06/2005

CALLAM, JEFFERSON, KING AND KITSAP COUNTIES

	Rates	Fringes
Cable splicer	$ 36.85	3%+12.64
Electrician	$ 33.50	3%+12.64

ELEC0048-003 01/01/2005

CLARK, KLICKITAT AND SKAMANIA COUNTIES

	Rates	Fringes
Cable splicer	$ 31.60	3%+$13.05
Electrician	$ 31.35	3%+$13.05

ELEC0073-001 07/01/2004

ADAMS, FERRY, LINCOLN, PEND OREILLE, SPOKANE, STEVENS, WHITMAN COUNTIES

	Rates	Fringes
Cable splicer	$ 24.07	3%+11.58
Electrician	$ 23.67	3%+11.58

ELEC0076-002 09/01/2004

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE, AND THURSTON COUNTIES

	Rates	Fringes
Cable splicer	$ 34.13	3%+12.56
Electrician	$ 30.75	3%+12.56

ELEC0077-002 02/01/2005

	Rates	Fringes
Line Construction:		

CABLE SPLICERS.....$ 39.48 3.875%+9.75
GROUNDMEN.....$ 24.68 3.875%+8.00
LINE EQUIPMENT MEN.....$ 30.32 3.875%+8.00
LINEMEN, POLE SPRAYERS,
HEAVY LINE EQUIPMENT MAN....$ 35.25 3.875%+9.75
POWDERMEN, JACKHAMMERMEN....$ 26.44 3.875%+8.00
TREE TRIMMER.....$ 20.98 3.875%+7.94

ELEC0112-005 06/01/2005

ASOTIN, BENTON, COLUMBIA, FRANKLIN, GARFIELD, KITTITAS, WALLA WALLA, YAKIMA COUNTIES

	Rates	Fringes
Cable splicer	$ 31.24	3%+12.28
Electrician	$ 29.90	3%+12.43

ELEC0191-003 09/01/2004

ISLAND, SAN JUAN, SNOHOMISH, SKAGIT AND WHATCOM COUNTIES

	Rates	Fringes
Cable splicer	$ 33.72	3%+10.33
Electrician	$ 30.66	3%+10.33

ELEC0191-004 09/01/2004

CHELAN, DOUGLAS, GRANT AND OKANOGAN COUNTIES

	Rates	Fringes
Cable splicer	$ 29.33	3%+10.28
Electrician	$ 26.66	3%+10.28

ELEC0970-001 01/01/2005

COWLITZ AND WAHKIAKUM COUNTIES

	Rates	Fringes
Cable splicer	$ 31.57	3%+10.60
Electrician	$ 28.70	3%+10.60

ENGI0302-003 06/01/2005

CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, DOUGLAS (WEST OF THE 120TH MERIDIAN), GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, KITTITAS, MASON, OKANOGAN (WEST OF THE 120TH MERIDIAN), SAN JUNA, SKAGIT, SNOHOMISH, WHATCOM AND YAKIMA (WEST OF THE 120TH MERIDIAN) COUNTIES

PROJECTS: CATEGORY A PROJECTS (EXCLUDES CATEGORY B PROJECTS, AS SHOWN BELOW)

Zone 1 (0-25 radius miles):

	Rates	Fringes
Power equipment operators:		
Group 1A	$ 31.08	11.05
Group 1AA	$ 31.63	11.05
Group 1AAA	$ 32.17	11.05

Group 1	$ 30.54	11.05
Group 2	$ 30.07	11.05
Group 3	$ 29.66	11.05
Group 4	$ 27.37	11.05

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) - $ .70
Zone 3 (Over 45 radius miles) - $1.00

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead 6 yards to, but not including 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9, HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self propelled 45 yards and over; Slipform pavers; Transporters, all truck or track type

GROUP 2 - Barrier machine (zipper); Batch Plant Operaor-Concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons; Chipper; Concrete Pump-truck mount with boom attachment; Crusher; Deck Engineer/Deck Winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing Machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Horizontal/directional drill operator; Loaders-overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics-all; Mixers-asphalt plant; Motor patrol graders-finishing; Piledriver (other than crane mount); Roto-mill,roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrade trimmer; Tractors, backhoes-over 75 hp; Transfer material service machine-shuttle buggy, blaw knox-roadtec; Truck crane oiler/driver-100 tons and over; Truck Mount portable conveyor; Yo Yo Pay dozer

GROUP 3 - Conveyors; Cranes-thru 19 tons with attachments; A-frame crane over 10 tons; Drill oilers-auger type, truck or crane mount; Dozers-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator;

Outside hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loader-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pumps-concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrpers-concrete and carry-all; Service engineer-equipment; Trenching machines; Truck Crane Oiler/Driver under 100 tons; Tractors, backhoe 75 hp and under

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete finish mahine-laser screed; Cranes-A frame-10 tons and under; Elevator and Manlift-permanent or shaft type; Gradechecker, Stakehop; Forklifts under 3000 lbs. with attachments; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger, mechanical; Power plant; Pumps, water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

CATEGORY B PROJECTS: 95% OF THE BASIC HOURLY RATE FOR EACH GROUP PLUS FULL FRINGE BENEFITS APPLICABLE TO CATEGORY A PROJECTS SHALL APPLY TO THE FOLLOWING PROJECTS. REDUCED RATES MAY BE PAID ON THE FOLLOWING:

1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than $1 million where no building is involved. Surfacing and paving including, but utilities excluded.
3. Marine projects (docks, wharfs, ect.) less than $150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designed hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing.
H-2 Class "C" Suit - Base wage rate plus $.25 per hour.
H-3 Class "B" Suit - Base wage rate plus $.50 per hour.
H-4 Class "A" Suit - Base wage rate plus $.75 per hour.

ENGI0302-009 06/01/2005

CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, DOUGLAS (WEST OF THE 120TH MERIDIAN), GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, KITTITAS, MASON, OKANOGAN (WEST OF THE 120TH MERIDIAN), SAN JUNA,SKAGIT, SNOHOMISH, WHATCOM AND YAKIMA (WEST OF THE 120TH MERIDIAN) COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 95% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

WORK PERFORMED ON HYDRAULIC DREDDGES:
Zone 1 (0-25 radius miles):

	Rates	Fringes

Power equipment operators:

GROUP 1		
TOTAL PROJECT COST		
$300,000 AND OVER.....	$ 29.23	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 26.96	8.40
GROUP 2		
TOTAL PROJECT COST		
$300,000 AND OVER.....	$ 29.35	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 27.06	8.40
GROUP 3		
TOTAL PROJECT COST		
$300,000 AND OVER.....	$ 29.72	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 27.38	8.40
GROUP 4		
TOTAL PROJECT COST		
$300,000 AND OVER.....	$ 29.77	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 27.43	8.40
GROUP 5		
TOATL PROJECT COST		
$300,000 AND OVER.....	$ 31.29	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 28.75	8.40
GROUP 6		
TOTAL PROJECT COST		
$300,000 AND OVER.....	$ 29.23	11.05
TOTAL PROJECT COST UNDER		
$300,000.....	$ 26.96	8.40

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) - $ .70
Zone 3 (Over 45 radius miles) - $1.00

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1 - ASSISTANT MATE (DECKHAND)
GROUP 2 - OILER
GROUP 3 - ASSISTANT ENGINEER (ELECTRIC, DIESEL, STEAM OR BOOSTER PUMP); MATES AND BOATMEN
GROUP 4 - CRANEMAN, ENGINEER WELDER
GROUP 5 - LEVERMAN, HYDRAULIC
GROUP 6 - MAINTENANCE

CATEGORY B PROJECTS: 95% OF THE BASIC HOURLY RATE FOR EACH GROUP PLUS FULL FRINGE BENEFITS APPLICABLE TO CATEGORY A PROJECTS SHALL APPLY TO THE FOLLOWING PROJECTS. REDUCED RATES MAY BE PAID ON THE FOLLOWING:

1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than $1 million where no building is involved. Surfacing and paving including, but utilities excluded.
3. Marine projects (docks, wharfs, ect.) less than $150,000.

HEAVY WAGE RATES (CATEGORY A) APPLIES TO CLAM SHELL DREDGE, HOE AND DIPPER, SHOVELS AND SHOVEL ATTACHMENTS, CRANES AND BULLDOZERS.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designed hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing.
H-2 Class "C" Suit - Base wage rate plus $.25 per hour.
H-3 Class "B" Suit - Base wage rate plus $.50 per hour.
H-4 Class "A" Suit - Base wage rate plus $.75 per hour.

ENGI0370-002 06/01/2005

ADAMS, ASOTIN, BENTON, CHELAN (EAST OF THE 120TH MERIDIAN), COLUMBIA, DOUGLAS (EAST OF THE 120TH MERIDIAN), FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN (EAST OF THE 120TH MERIDIAN), PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA (EAST OF THE 120TH MERIDIAN) COUNTIES

ZONE 1:

	Rates	Fringes
Power equipment operators:		
GROUP 1A	$ 21.79	7.87
GROUP 1	$ 22.34	7.87
GROUP 2	$ 22.66	7.87
GROUP 3	$ 23.27	7.87
GROUP 4	$ 23.43	7.87
GROUP 5	$ 23.59	7.87
GROUP 6	$ 23.87	7.87
GROUP 7	$ 24.14	7.87
GROUP 8	$ 25.24	7.87

ZONE DIFFERENTIAL (Add to Zone 1 rate): Zone 2 - $2.00

Zone 1: Within 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1A: Boat Operator; Crush Feeder; Oiler; Steam Cleaner

GROUP 1: Bit Grinders; Bolt Threading Machine; Compressors (under 2000 CFM, gas, diesel, or electric power); Deck Hand; Drillers Helper (Assist driller in making drill rod connections, service drill engine and air compressor, repair drill rig and drill tools, drive drill support truck to and on the job site, remove drill cuttings from around bore hole and inspect drill rig while in operation); Fireman & Heater Tender; Grade Checker; Hydro-seeder, Mulcher, Nozzleman; Oiler Driver, & Cable Tender, Mucking Machine; Pumpman; Rollers, all types on subgrade, including seal and chip coatings (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by

Dozer with operable blade; Welding Machine

GROUP 2: A-frame Truck (single drum); Assistant Refrigeration Plant (under 1000 ton); Assistant Plant Operator, Fireman or Pugmixer (asphalt); Bagley or Stationary Scraper; Belt Finishing Machine; Blower Operator (cement); Cement Hog; Compressor (2000 CFM or over, 2 or more, gas diesel or electric power); Concrete Saw (multiple cut); Distributor Leverman; Ditch Witch or similar; Elevator Hoisting Materials; Dope Pots (power agitated); Fork Lift or Lumber Stacker, hydra-lift & similar; Gin Trucks (pipeline); Hoist, single drum; Loaders (bucket elevators and conveyors); Longitudinal Float; Mixer (portable-concrete); Pavement Breaker, Hydra-Hammer & similar; Power Broom; Railroad Ballast Regulation Operator (self-propelled); Railroad Power Tamper Operator (self-propelled); Railroad Tamper Jack Operator (self-propelled; Spray Curing Machine (concrete); Spreader Box (self-propelled); Straddle Buggy (Ross & similar on construction job only); Tractor (Farm type R/T with attachment, except Backhoe); Tugger Operator

GROUP 3: A-frame Truck (2 or more drums); Assistant Refrigeration Plant & Chiller Operator (over 1000 ton); Backfillers (Cleveland & similar); Batch Plant & Wet Mix Operator, single unit (concrete); Belt-Crete Conveyors with power pack or similar; Belt Loader (Kocal or similar); Bending Machine; Bob Cat; Boring Machine (earth); Boring Machine (rock under 8 inch bit) (Quarry Master, Joy or similar); Bump Cutter (Wayne, Saginau or similar); Canal Lining Machine (concrete); Chipper (without crane); Cleaning & Doping Machine (pipeline); Deck Engineer; Elevating Belt-type Loader (Euclid, Barber Green & similar); Elevating Grader-type Loader (Dumor, Adams or similar); Generator Plant Engineers (diesel or electric); Gunnite Combination Mixer & Compressor; Locomotive Engineer; Mixermobile; Mucking Machine; Posthole Auger or Punch; Pump (grout or jet); Soil Stabilizer (P & H or similar); Spreader Machine; Tractor (to D-6 or equivalent) and Traxcavator; Traverse Finish Machine; Turnhead Operator

GROUP 4: Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman & similar); Curb Extruder (asphalt or concrete); Drills (churn, core, calyx or diamond)(operate drilling machine, drive or transport drill rig to and on job site and weld well casing); Equipment Serviceman; Greaser & Oiler; Hoist (2 or more drums or Tower Hoist); Loaders (overhead & front-end, under 4 yds. R/T); Refrigeration Plant Engineer (under 1000 ton); Rubber-tired Skidders (R/T with or without attachments); Surface Heater & Plant Machine; Trenching Machines (under 7 ft. depth capacity); Turnhead (with re-screening); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (under 45,000 gw); Backhoe & Hoe Ram (under 3/4 yd.); Carrydeck & Boom Truck (under 25 tons); Cranes (25 tons & under), all attachments including clamshell, dragline; Derricks & Stifflegs (under 65 tons); Drilling Equipment(8 inch bit & over) (Robbins, reverse circulation & similar)(operates drilling machine, drive or transport drill rig to and on job site and weld well casing); Hoe Ram; Piledriving Engineers; Paving (dual drum); Railroad Track Liner Operaotr (self-propelled); Refrigeration Plant Engineer (1000 tons & over); Signalman (Whirleys, Highline Hammerheads or similar)

GROUP 6: Asphalt Plant Operator; Automatic Subgrader (Ditches & Trimmers)(Autograde, ABC, R.A. Hansen & similar on grade wire); Backhoe (45,000 gw and over to 110,000 gw); Backhoes & Hoe Ram (3/4 yd. to 3 yd.); Batch Plant (over 4 units); Batch & Wet Mix Operator (multiple units, 2 & incl. 4); Blade Operator (motor patrol & attachments, Athey & Huber); Boom Cats (side); Cable Controller (dispatcher); Clamshell Operator (under 3 yds.); Compactor (self-propelled with blade); Concrete Pump Boom Truck; Concrete Slip Form Paver; Cranes (over 25 tons, to and including 45 tons), all attachments including clamshell, dragline; Crusher, Grizzle & Screening Plant Operator; Dozer, 834 R/T & similar; Draglines (under 3 yds.); Drill Doctor; H.D. Mechanic; H.D. Welder; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.); Multiple Dozer Units with single blade; Paving Machine (asphalt and concrete); Quad-Track or similar equipment; Rollerman (finishing asphalt pavement); Roto Mill (pavement grinder); Scrapers, all, rubber-tired; Screed Operator; Shovel(under 3 yds.); Tractors (D-6 & equilvalent & over); Trenching Machines (7 ft. depth & over); Tug Boat Operator Vactor guzzler, super sucker

GROUP 7: Backhoe (over 110,000 gw); Backhoes & Hoe Ram (3 yds & over); Blade (finish & bluetop) Automatic, CMI, ABC, Finish Athey & Huber & similar when used as automatic; Cableway Operators; Concrete Cleaning/Decontamination machine operator; Cranes (over 45 tons to but not including 85 tons), all attachments including clamshell and dragine; Derricks & Stiffleys (65 tons & over); Elevating Belt (Holland type); Heavy equipment robotics operator; Loader (360 degrees revolving Koehring Scooper or similar); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Shovels (3 yds. & over); Whirleys & Hammerheads, ALL

GROUP 8: Cranes (85 tons and over, and all climbing, overhead,rail and tower), all attachments including clamshell, dragline; Loaders (overhead and front-end, 10 yards and over); Helicopter Pilot

BOOM PAY: (All Cranes, Including Tower)
180 ft to 250 ft $ .30 over scale
Over 250 ft $ .60 over scale

NOTE:
In computing the length of the boom on Tower Cranes, they shall be measured from the base of the Tower to the point of the boom.

HAZMAT:
Anyone working on HAZMAT jobs, working with supplied air shall receive $1.00 an hour above classification.

ENGI0370-006 06/01/2005

ADAMS, ASOTIN, BENTON, CHELAN (EAST OF THE 120TH MERIDIAN), COLUMBIA, DOUGLAS (EAST OF THE 120TH MERIDIAN), FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN (EAST OF THE 120TH MERIDIAN), PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA (EAST OF THE 120TH MERIDIAN) COUNTIES

WORK PERFORMED ON HYDRAULIC DREDGES

	Rates	Fringes
Hydraulic Dredge		
GROUP 1:.....	$ 32.41	7.87
GROUP 2:.....	$ 32.53	7.87
GROUP 3:.....	$ 32.90	7.87
GROUP 4:.....	$ 32.95	7.87
GROUP 5:.....	$ 34.47	7.87
GROUP 6:.....	$ 32.41	7.87

GROUP 1: Assistant Mate (Deckhand)
GROUP 2: Assistant Engineer (Electric, Diesel, Steam, or Booster Pump); Mates and Boatmen
GROUP 3: Engineer Welder
GROUP 4: Leverman, Hydraulic
GROUP 5: Maintenance
GROUP 6: Oiler

HEAVY WAGE RATES APPLIES TO CLAM SHELL DREDGE, HOE AND DIPPER, SHOVELS AND SHOVEL ATTACHMENTS, CRANES AND BULLDOZERS.

ENGI0612-001 06/01/2005

LEWIS, PIERCE, PACIFIC (THAT PORTION WHICH LIES NORTH OF A PARALLEL LINE EXTENDED WEST FROM THE NORTHERN BOUNDARY OF WAHKAIKUM COUNTY TO THE SEA IN THE STATE OF WASHINGTON) AND THURSTON COUNTIES

PROJECTS:
CATEGORY A PROJECTS (excludes Category B projects, as shown below)

	Rates	Fringes
Power equipment operators:		
WORK PERFORMED ON HYDRAULIC DREDGES:Total Project cost $300,000 and over		
GROUP 1.....	$ 29.23	11.05
GROUP 2.....	$ 29.35	11.05
GROUP 3.....	$ 29.71	11.05
GROUP 4.....	$ 29.77	11.05
GROUP 5.....	$ 31.29	11.05
GROUP 6.....	$ 29.23	11.05
WORK PERFORMED ON HYDRAULIC DREDGES:Total Project Cost under $300,000		
GROUP 1.....	$ 26.96	8.40
GROUP 2.....	$ 27.06	8.40
GROUP 3.....	$ 27.38	8.40
GROUP 4.....	$ 27.43	8.40
GROUP 5.....	$ 28.75	8.40
GROUP 6.....	$ 26.96	8.40

ZONE 2 (26-45 radius miles) - Add $.70 to Zone 1 rates
ZONE 3 (Over 45 radius miles) - Add $1.00 to Zone 1 rates

BASEPOINTS: Tacoma, Olympia, and Centralia

CATEGORY B PROJECTS - 95% of the basic hourly rate for each group plus full fringe benefits applicable to Category A

projects shall apply to the following projects: Reduced rates may be paid on the following:
1. Projects involving work on structures such as buildings and structures whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than $1 million where no building is involved. Surfacing and paving included, but utilities excluded.
3. Marine projects (docts, wharfs, etc.) less than $150,000

WORK PERFORMED ON HYDRAULIC DREDGES:

GROUP 1: Assistant Mate (Deckhand
GROUP 2: Oiler
GROUP 3: Assistant Engineer (Electric, Diesel, Steam or Booster Pump); Mates and Boatmen
GROUP 4: Craneman, Engineer Welder
GROUP 5: Leverman, Hydraulic GROUP 6: Maintenance

HEAVY WAGE RATES APPLIES TO CLAM SHEEL DREDGE, HOE AND DIPPER, SHOVELS AND SHOVEL ATTACHMENTS, CRANES AND BULLDOZERS

HANDLING OF HAZARDOUS WASTE MATERIALS

H-1 - When not outfitted with protective clothing of level D equipment - Base wage rate
H-2 - Class "C" Suit - Base wage rate + $.25 per hour
H-3 - Class "B" Suit - Base wage rate + $.50 per hour
H-4 - Class "A" Suit - Base wage rate +$.75 per hour

ENGI0612-002 06/01/2005

LEWIS, PIERCE, PACIFIC (portion lying north of a parallel line extending west from the northern boundary of Wahkaikum County to the sea) AND THURSTON COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes
Power equipment operators:		
GROUP 1A	$ 31.08	11.05
GROUP 1AA	$ 31.63	11.05
GROUP 1AAA	$ 32.17	11.05
GROUP 1	$ 30.54	11.05
GROUP 2	$ 30.07	11.05
GROUP 3	$ 29.66	11.05
GROUP 4	$ 27.37	11.05

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) = $ .70
Zone 3 (Over 45 radius miles) - $1.00

BASEPOINTS: CENTRALIA, OLYMPIA, TACOMA

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1 AAA - Cranes-over 300 tons or 300 ft of boom

(including jib with attachments)

GROUP 1AA - Cranes- 200 tonsto 300 tons, or 250 ft of boom (including jib with attachments; Tower crane over 175 ft in height, bas to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead, 6 yards to, but not including, 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9 HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self-propelled 45 yards and over; Slipform pavers; Transporters, all track or truck type

GROUP 2 - Barrier machine (zipper); Batch Plant Operator-concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-Overhead, bridge type, 20 tons through 44 tons; Chipper; Concrete pump-truck mount with boom attachment; Crusher; Deck engineer/deck winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Loaders, overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics- all; Mixers, asphalt plant; Motor patrol graders, finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self- propelled, hard tail end dump, articulating off-road equipment- under 45 yards; Subgrader trimmer; Tractors, backhoe over 75 hp; Transfer material service machine-shuttle buggy, Blaw Knox- Roadtec; Truck Crane oiler/driver-100 tons and over; Truck Mount Portable Conveyor; Yo Yo pay

GROUP 3 - Conveyors; Cranes through 19 tons with attachments; Crane-A-frame over 10 tons; Drill oilers-auger type, truck or crane mount; Dozer-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside Hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loaders-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pump-Concrete; Roller, plant mix or multi-lfit materials; Saws-concrete; Scrapers, concrete and carry all; Service engineers-equipment; Trenching machines; Truck crane oiler/driver under 100 tons; Tractors, backhoe under 75 hp

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete Finish Machine-laser screed; Cranes A-frame 10 tons and under; Elevator and manlift (permanent and shaft type); Forklifts-under 3000 lbs. with attachments; Gradechecker, stakehop; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole

digger-mechanical; Power plant; Pumps-water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.

2. Projects of less than $1 million where no building is involved. Surfacing and paving included, but utilities excluded.

3. Marine projects (docks, wharfs, etc.) less than $150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing
H-2 Class "C" Suit - Base wage rate plus $ .25 per hour.
H-3 Class "B" Suit - Base wage rate plus $ .50 per hour.
H-4 Class "A" Suit - Base wage rate plus $ .75 per hour.

ENGI0701-002 01/01/2005

CLARK, COWLITZ, KLICKKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Power equipment operators: (See Footnote A)		
GROUP 1	$ 30.44	9.95
GROUP 1A	$ 31.96	9.95
GROUP 1B	$ 33.48	9.95
GROUP 2	$ 29.14	9.95
GROUP 3	$ 28.34	9.95
GROUP 4	$ 27.78	9.95
GROUP 5	$ 27.15	9.95
GROUP 6	$ 24.66	9.95

Zone Differential (add to Zone 1 rates):
Zone 2 - $1.50
Zone 3 - 3.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or porjects located in Clark & Cowlitz County, Washington except that portion of Cowlitz County in the Mt.

St. Helens "Blast Zone" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: CONCRETE: Batch Plant and/or Wet Mix Operator, three units or more; CRANE: Helicopter Operator, when used in erecting work; Whirley Operator, 90 ton and over; LATTICE BOOM CRANE: Operator 200 tons through 299 tons, and/or over 200 feet boom; HYDRAULIC CRANE: Hydraulic Crane Operator 90 tons through 199 tons with luffing or tower attachments; FLOATING EQUIPMENT: Floating Crane, 150 ton but less than 250 ton

GROUP 1A: HYDRAULIC CRANE: Hydraulic Operator, 200 tons and over (with luffing or tower attachment); LATTICE BOOM CRANE: Operator, 200 tons through 299 tons, with over 200 feet boom; FLOATING EQUIPMENT: Floating Crane 250 ton and over

GROUP 1B: LATTICE BOOM CRANE: Operator, 300 tons through 399 tons with over 200 feet boom; Operator 400 tons and over; FLOATING EQUIPMENT: Floating Crane 350 ton and over

GROUP 2: ASPHALT: Asphalt Plant Operator (any type); Roto Mill, pavement profiler, operator, 6 foot lateral cut and over; BLADE: Auto Grader or "Trimmer" (Grade Checker required); Blade Operator, Robotic; BULLDOZERS: Bulldozer operator over 120,000 lbs and above; Bulldozer operator, twin engine; Bulldozer Operator,tandem, quadnine, D10, D11, and similar type; Bulldozere Robotic Equipment (any type; CONCRETE: Batch Plant and/or Wet Mix Operator, one and two drum; Automatic Concrete Slip Form Paver Operator; Concrete Canal Line Operator; Concrete Profiler, Diamond Head; CRANE: Cableway Operator, 25 tons and over; HYDRAULIC CRANE: Hydraulic crane operator 90 tons through 199 tons (with luffing or tower attachment); TOWER/WHIRLEY OPERATOR: Tower Crane Operator; Whirley Operator, under 90 tons; LATTICE BOOM CRANE: 90 through 199 tons and/or 150 to 200

feet boom; CRUSHER: Crusher Plant Operator; FLOATING EQUIPMENT: Floating Clamshell, etc.operator, 3 cu. yds. and over; Floating Crane (derrick barge) Operator, 30 tons but less than 150 tons; LOADERS: Loader operator, 120,000 lbs. and above; REMOTE CONTROL: Remote controlled earth-moving equipment; RUBBER-TIRED SCRAPERS: Rubber-tired scraper operator, with tandem scrapers, multi-engine; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Shovel, Dragline, Clamshell, operator 5 cu. yds and over; TRENCHING MACHINE: Wheel Excavator, under 750 cu. yds. per hour (Grade Oiler required); Canal Trimmer (Grade Oiler required); Wheel Excavator, over 750 cu. yds. per hour; Band Wagon (in conjunction with wheel excavator); UNDERWATER EQUIPMENT: Underwater Equipment Operator, remote or otherwise; HYDRAULIC HOES-EXCAVATOR: Excavator over 130,000 lbs.

GROUP 3: BULLDOZERS: Bulldozer operator, over 70,000 lbs. up to and including 120,000 lbs.; HYDRAULIC CRANE: Hydraulic crane operator, 50 tons through 89 tons (with luffing or tower attachment); LATTICE BOOM CRANES: Lattice Boom Crane-50 through 89 tons (and less than 150 feet boom); FORKLIFT: Rock Hound Operator; HYDRAULIC HOES-EXCAVATOR: excavator over 80,000 lbs. through 130,000 lbs.; LOADERS: Loader operator 60,000 and less than 120,000; RUBBER-TIRED SCRAPERS: Scraper Operator, with tandem scrapers; Self-loading, paddle wheel, auger type, finish and/or 2 or more units; SHOVEL, DRAGLINE, CLAMSHELL,SKOOPER OPERATOR: Shovel, Dragline, Clamshell operators 3 cu. yds. but less than 5 cu yds.

GROUP 4: ASPHALT: Screed Operator; Asphalt Paver operator (screeman required); BLADE: Blade operator; Blade operator, finish; Blade operator, externally controlled by electronic, mechanical hydraulic means; Blade operator, multi-engine; BULLDOZERS: Bulldozer Operator over 20,000 lbs and more than 100 horse up to 70,000 lbs; Drill Cat Operator; Side-boom Operator; Cable-Plow Operator (any type); CLEARING: Log Skidders; Chippers; Incinerator; Stump Splitter (loader mounted or similar type); Stump Grinder (loader mounted or similar type; Tub Grinder; Land Clearing Machine (Track mounted forestry mowing & grinding machine); Hydro Axe (loader mounted or similar type); COMPACTORS SELF-PROPELLED: Compactor Operator, with blade; Compactor Operator, multi-engine; Compactor Operator, robotic; CONCRETE: Mixer Mobile Operator; Screed Operator; Concrete Cooling Machine Operator; Concrete Paving Road Mixer; Concrete Breaker; Reinforced Tank Banding Machine (K-17 or similar types); Laser Screed; CRANE: Chicago boom and similar types; Lift Slab Machine Operator; Boom type lifting device, 5 ton capacity or less; Hoist Operator, two (2) drum; Hoist Operator, three (3) or more drums; Derrick Operator, under 100 ton; Hoist Operator, stiff leg, guy derrick or similar type, 50 ton and over; Cableway Operator up to twenty (25) ton; Bridge Crane Operator, Locomotive, Gantry, Overhead; Cherry Picker or similar type crane; Carry Deck Operator; Hydraulic Crane Operator, under 50 tons; LATTICE BOOM CRANE OPERATOR: Lattice Boom Crane Operator, under 50 tons; CRUSHER: Generator Operator; Diesel-Electric Engineer; Grizzley Operator; Drill Doctor; Boring Machine Operator; Driller-Percussion, Diamond, Core, Cable, Rotary and similar type; Cat Drill (John Henry); Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Diesel-electric Engineer; Jack

Operator, elevating barges, Barge Operator, self-unloading; Piledriver Operator (not crane type) (Deckhand required); Floating Clamshelll, etc. Operator, under 3 cu. yds. (Fireman or Diesel-Electric Engineer required); Floating Crane (derrick barge) Operator, less than 30 tons; GENERATORS: Generator Operator; Diesel-electric Engineer; GUARDRAIL EQUIPMENT: Guardrail Punch Operator (all types); Guardrail Auger Operator (all types); Combination Guardrail machines, i.e., punch auger, etc.; HEATING PLANT: Surface Heater and Planer Operator; HYDRAULIC HOES EXCAVATOR: Robotic Hydraulic backhoe operator, track and wheel type up to and including 20,0000 lbs. with any or all attachments; Excavator Operator over 20,000 lbs through 80,000 lbs.; LOADERS: Belt Loaders, Kolman and Ko Cal types; Loaders Operator, front end and overhead, 25,000 lbs and less than 60,000 lbs; Elevating Grader Operator by Tractor operator, Sierra, Euclid or similar types; PILEDRIVERS: Hammer Operator; Piledriver Operator (not crane type); PIPELINE, SEWER WATER: Pipe Cleaning Machine Operator; Pipe Doping Machine Operator; Pipe Bending Machine Operator; Pipe Wrapping Machine Operator; Boring Machine Operator; Back Filling Machine Operator; REMOTE CONTROL: Concrete Cleaning Decontamination Machine Operator; Ultra High Pressure Water Jet Cutting Tool System Operator/Mechanic; Vacuum Blasting Machine Operator/mechanic; REPAIRMEN, HEAVY DUTY: Diesel Electric Engineer (Plant or Floating; Bolt Threading Machine operator; Drill Doctor (Bit Grinder); H.D. Mechanic; Machine Tool Operator; RUBBER-TIRED SCRAPERS: Rubber-tired Scraper Operator,single engine, single scraper; Self-loading, paddle wheel, auger type under 15 cu. yds.; Rubber-tired Scraper Operator, twin engine; Rubber-tired Scraper Operator, with push- ull attachments; Self Loading, paddle wheel, auger type 15 cu. yds. and over, single engine; Water pulls, water wagons; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Diesel Electric Engineer; Stationay Drag Scraper Operator; Shovel, Dragline, Clamshell, Operator under 3 cy yds.; Grade-all Operator; SURFACE (BASE) MATERIAL: Blade mounted spreaders, Ulrich and similar types; TRACTOR-RUBBERED TIRED: Tractor operator, rubber-tired, over 50 hp flywheel; Tractor operator, with boom attachment; Rubber-tired dozers and pushers (Michigan, Cat, Hough type); Skip Loader, Drag Box; TRENCHING MACHINE: Trenching Machine operator, digging capacity over 3 ft depth; Back filling machine operator; TUNNEL: Mucking machine operator

GROUP 5: ASPHALT: Extrusion Machine Operator; Roller Operator (any asphalt mix); Asphalt Burner and Reconditioner Operator (any type); Roto-Mill, pavement profiler, ground man; BULLDOZERS: Bulldozer operator, 20,000 lbs. or less or 100 horse or less; COMPRESSORS: Compressor Operator (any power), over 1,250 cu. ft. total capacity; COMPACTORS: Compactor Operator, including vibratory; Wagner Pactor Operator or similar type (without blade); CONCRETE: Combination mixer and Compressor Operator, gunite work; Concrete Batch Plant Quality Control Operator; Beltcrete Operator; Pumpcrete Operator (any type); Pavement Grinder and/or Grooving Machine Operator (riding type); Cement Pump Operator, Fuller-Kenyon and similar; Concrete Pump Operator; Grouting Machine Operator; Concrete mixer operator, single drum, under (5) bag capacity; Cast in place pipe laying machine; maginnis Internal Full slab vibrator operator; Concrete finishing mahine operator, Clary, Johnson, Bidwell, Burgess Bridge

deck or similar type; Curb Machine Operator, mechanical Berm, Curb and/or Curb and Gutter; Concrete Joint Machine Operator; Concrete Planer Operator; Tower Mobile Operator; Power Jumbo Operator setting slip forms in tunnels; Slip Form Pumps, power driven hydraulic lifting device for concrete forms; Concrete Paving Machine Operator; Concrete Finishing Machine Operator; Concrete Spreader Operator; CRANE: Helicopter Hoist Operator; Hoist Operator, single drum; Elevator Operator; A-frame Truck Operator, Double drum; Boom Truck Operator; HYDRAULIC CRANE OPERATOR: Hydraulic Boom Truck, Pittman; DRILLING: Churm Drill and Earth Boring Machine Operator; Vacuum Truck; Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Fireman; FORKLIFT: Fork Lift, over 10 ton and/or robotic; HYDRAULIC HOES EXCAVATORS: Hydraulic Backhoe Operator, wheel type (Ford, John Deere, Case type); Hydraulic Backhoe Operator track type up to and including 20,000 lbs.; LOADERS: Loaders, rubber- tired type, less than 25,000 lbs; Elevating Grader Operator, Tractor Towed requiring Operator or Grader; Elevating loader operator, Athey and similar types; OILERS: Service oiler (Greaser); PIPELINE-SEWER WATER: Hydra hammer or simialr types; Pavement Breaker Operator; PUMPS: Pump Operator, more than 5 (any size); Pot Rammer Operator; RAILROAD EQUIPMENT: Locomotive Operator, under 40 tons; Ballast Regulator Operator; Ballast Tamper Multi-Purpose Operator; Track Liner Operator; Tie Spacer Operator; Shuttle Car Operator; Locomotive Operator, 40 tons and over; MATERIAL HAULRS: Cat wagon DJBs Volvo similar types; Conveyored material hauler; SURFACING (BASE) MATERIAL: Rock Spreaders, self-propelled; Pulva-mixer or similar types; Chiip Spreading machine operator; Lime spreading operator, construction job siter; SWEEPERS: Sweeper operator (Wayne type) self-propelled construction job site; TRACTOR-RUBBER TIRED: Tractor operator, rubber-tired, 50 hp flywheel and under; Trenching machine operator, maximum digging capacity 3 ft depth; TUNNEL: Dinkey

GROUP 6: ASPHALT: Plant Oiler; Plant Fireman; Pugmill Operator (any type); Truck mounted asphalt spreader, with screed; COMPRESSORS: Compressor Operator (any power), under 1,250 cu. ft. total capacity; CONCRETE: Plant Oiler, Assistant Conveyor Operator; Conveyor Operator; Mixer Box Operator (C.T.B., dry batch, etc.); Cement Hog Operator; Concrete Saw Operator; Concrete Curing Machine Operator (riding type); Wire Mat or Brooming Machine Operator; CRANE: Oiler; Fireman, all equipment; Truck Crane Oiler Driver; A-frame Truck Operator, single drum; Tugger or Coffin Type Hoist Operator; CRUSHER: Crusher Oiler; Crusher Feederman; CRUSHER: Crusher oiler; Crusher feederman; DRILLING: Drill Tender; Auger Oiler; FLOATING EQUIPMENT: Deckhand; Boatman; FORKLIFT: Self-propelled Scaffolding Operator, construction job site (exclduing working platform); Fork Lift or Lumber Stacker Operator, construction job site; Ross Carrier Operator, construction job site; Lull Hi-Lift Operator or Similar Type; GUARDRAIL EQUIPMENT: Oiler; Auger Oiler; Oiler, combination guardrail machines; Guardrail Punch Oiler; HEATING PLANT: Temporary Heating Plant Operator; LOADERS: Bobcat, skid steer (less than 1 cu yd.); Bucket Elevator Loader Operator, BarberGreene and similar types; OILERS: Oiler; Guardrail Punch Oiler; Truck Crane Oiler-Driver; Auger Oiler; Grade Oiler, required to check grade; Grade Checker; Rigger; PIPELINE-SEWER WATER: Tar Pot Fireman; Tar Pot Fireman

(power agitated); PUMPS: Pump Operator (any power); Hydrostatic Pump Operator; RAILROAD EQUIPMENT: Brakeman; Oiler; Switchman; Motorman; Ballast Jack Tamper Operator; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER, ETC. OPERATOR: Oiler, Grade Oiler (required to check grade); Grade Checker; Fireman; SWEEPER: Broom operator, self propelled, construction job site; SURFACING (BASE) MATERIAL: Roller Operator, grading of base rock (not asphalt); Tamping Machine operartor, mechanical, self-propelled; Hydrographic Seeder Machine Operator; TRENCHING MACHINE: Oiler; Grade Oiler; TUNNEL: Conveyor operator; Air filtration equipment operator

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ENGI0701-003 06/01/2005

CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

DREDGING:

	Rates	Fringes
Dredging:		
ZONE A		
ASSISTANT ENGINEER	$ 32.02	9.75
ASSISTANT MATE	$ 28.12	9.75
LEVERMAN, DIPPER, FLOATING CLAMSHELL	$ 34.34	9.75
LEVERMAN, HYDRAULIC	$ 34.34	9.75
TENDERMAN	$ 30.96	9.75
ZONE B		
ASSISTANT ENGINEER	$ 34.02	9.75
ASSISTANT MATE	$ 30.12	9.75
LEVERMAN, DIPPER, FLOATING CLAMSHELL	$ 36.34	9.75
LEVERMAN, HYDRAULIC	$ 36.34	9.75
TENDERMAN	$ 32.96	9.75
ZONE C		
ASSISTANT ENGINEER	$ 35.02	9.75
ASSISTANT MATE	$ 31.12	9.75
LEVERMAN, DIPPER, FLOATING CLAMSHELL	$ 37.34	9.75
LEVERMAN, HYDRAULIC	$ 37.34	9.75
TENDERMAN	$ 33.96	9.75

ZONE DESCRIPTION FOR DREDGING:

ZONE A - All jobs or projects located within 30 road miles of Portland City Hall.
ZONE B - Over 30-50 road miles from Portland City Hall.
ZONE C - Over 50 road miles from Portland City Hall.

*All jobs or projects shall be computed from the city hall by the shortest route to the geographical center of the project.

IRON0014-005 07/01/2004

ADAMS, ASOTIN, BENTON, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN, PEND ORIELLE, SPOKANE, STEVENS, WALLA WALLA AND WHITMAN COUNTIES

	Rates	Fringes

Ironworker.....$ 26.87 13.30

IRON0029-002 07/01/2004

CLARK, COWLITZ, KLICKITAT, PACIFIC, SKAMANIA, AND WAHKAIKUM COUNTIES

	Rates	Fringes
Ironworker	$ 28.47	13.30

IRON0086-002 07/01/2004

YAKIMA, KITTITAS AND CHELAN COUNTIES

	Rates	Fringes
Ironworker	$ 28.02	13.30

IRON0086-004 07/01/2004

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SKAGIT, SNOHOMISH, THURSTON, AND WHATCOM COUNTIES

	Rates	Fringes
Ironworker	$ 29.82	13.30

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* LABO0001-002 06/01/2005

ZONE 1:

	Rates	Fringes
Laborers:		
CALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTH OF STRAIGHT LINE MADE BY EXTENDING THE NORTH BOUNDARY WAHKIAKUM COUNTY WEST TO THE PACIFIC OCEAN), PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES		
GROUP 1	$ 18.56	7.95
GROUP 2	$ 20.88	7.95
GROUP 3	$ 25.56	7.95
GROUP 4	$ 26.04	7.95
GROUP 5	$ 26.40	7.95
CHELAN, DOUGLAS (WEST OF THE 120TH MERIDIAN), KITTITAS AND YAKIMA COUNTIES		
GROUP 1	$ 15.14	7.95
GROUP 2	$ 17.46	7.95
GROUP 3	$ 19.18	7.95
GROUP 4	$ 19.66	7.95
GROUP 5	$ 20.02	7.95

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $ .70
ZONE 3 - $1.00

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Mortarman and Hodcarrier; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Powderman; Re-Timberman; Hazardous Waste Worker (Level A).

LABO0238-004 06/01/2005

ADAMS, ASOTIN, BENTON, COLUMBIA, DOUGLAS (EAST OF THE 120TH MERIDIAN), FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN, PEND OREILLE, STEVENS, SPOKANE, WALLA WALLA AND WHITMAN COUNTIES

	Rates	Fringes
Laborers:		
ZONE 1:		
GROUP 1	$ 17.71	6.95
GROUP 2	$ 19.81	6.95
GROUP 3	$ 20.08	6.95
GROUP 4	$ 20.35	6.95
GROUP 5	$ 20.63	6.95
GROUP 6	$ 22.00	6.95

Zone Differential (Add to Zone 1 rate): $2.00

BASE POINTS: Spokane, Moses Lake, Pasco, Lewiston

Zone 1: 0-45 radius miles from the main post office.
Zone 2: 45 radius miles and over from the main post office.

LABORERS CLASSIFICATIONS

GROUP 1: Flagman; Landscape Laborer; Scaleman; Traffic Control Maintenance Laborer (to include erection and maintenance of barricades, signs and relief of flagperson); Window Washer/Cleaner (detail cleanup, such as, but not limited to cleaning floors, ceilings, walls, windows, etc. prior to final acceptance by the owner)

GROUP 2: Asbestos Abatement Worker; Brush Hog Feeder; Carpenter Tender; Cement Handler; Clean-up Laborer; Concrete Crewman (to include stripping of forms, hand operating jacks on slip form construction, application of concrete curing compounds, pumpcrete machine, signaling, handling the nozzle of squeezcrete or similar machine,6 inches and smaller); Confined Space Attendant; Concrete Signalman; Crusher Feeder; Demolition (to include clean-up, burning, loading, wrecking and salvage of all material); Dumpman; Fence Erector; Firewatch; Form Cleaning Machine Feeder, Stacker; General Laborer; Grout Machine Header Tender; Guard Rail (to include guard rails, guide and reference posts, sign posts, and right-of-way markers); Hazardous Waste Worker, Level D (no respirator is used and skin protection is minimal); Miner, Class "A" (to include all bull gang, concrete crewman, dumpman and pumpcrete crewman, including distributing pipe, assembly & dismantle, and nipper); Nipper; Riprap Man; Sandblast Tailhoseman; Scaffold Erector (wood or steel); Stake Jumper; Structural Mover (to include separating foundation, preparation, cribbing, shoring, jacking and unloading of structures); Tailhoseman (water nozzle); Timber Bucker and Faller (by hand); Track Laborer (RR); Truck Loader; Well-Point Man; All Other Work Classifications Not Specially Listed Shall Be Classified As General Laborer

GROUP 3: Aspahlt Raker; Asphalt Roller, walking; Cement Finisher Tender; Concrete Saw, walking; Demolition Torch;

Dope Pot Firemen, non-mechanical; Driller Tender (when required to move and position machine); Form Setter, Paving; Grade Checker using level; Hazardous Waste Worker, Level C (uses a chemical "splash suit" and air purifying respirator); Jackhammer Operator; Miner, Class "B" (to include brakeman, finisher, vibrator, form setter); Nozzleman (to include squeeze and flo-crete nozzle); Nozzleman, water, air or steam; Pavement Breaker (under 90 lbs.); Pipelayer, corrugated metal culvert; Pipelayer, multi- plate; Pot Tender; Power Buggy Operator; Power Tool Operator, gas, electric, pneumatic; Railroad Equipment, power driven, except dual mobile power spiker or puller; Railroad Power Spiker or Puller, dual mobile; Rodder and Spreader; Tamper (to include operation of Barco, Essex and similar tampers); Trencher, Shawnee; Tugger Operator; Wagon Drills; Water Pipe Liner; Wheelbarrow (power driven)

GROUP 4: Air and Hydraulic Track Drill; Brush Machine (to include horizontal construction joint cleanup brush machine, power propelled); Caisson Worker, free air; Chain Saw Operator and Faller; Concrete Stack (to include laborers when laborers working on free standing concrete stacks for smoke or fume control above 40 feet high); Gunite (to include operation of machine and nozzle); Hazardous Waste Worker, Level B (uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Laser Beam Operator (to include grade checker and elevation control); Miner, Class C (to include miner, nozzleman for concrete, laser beam operator and rigger on tunnels); Monitor Operator (air track or similar mounting); Mortar Mixer; Nozzleman (to include jet blasting nozzleman, over 1,200 lbs., jet blast machine power propelled, sandblast nozzle); Pavement Breaker (90 lbs. and over); Pipelayer (to include working topman, caulker, collarman, jointer, mortarman, rigger, jacker, shorer, valve or meter installer); Pipewrapper; Plasterer Tender; Vibrators (all)

GROUP 5 - Drills with Dual Masts; Hazardous Waste Worker, Level A (utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line); Miner Class "D", (to include raise and shaft miner, laser beam operator on riases and shafts)

GROUP 6 - Powderman

LABO0238-006 06/01/2004

COUNTIES EAST OF THE 120TH MERIDIAN: ADAMS, ASOTIN, BENTON, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN, PEND OREILLE, STEVENS, SPOKANE, WALLA WALLA, WHITMAN

	Rates	Fringes
Hod Carrier	$ 21.05	6.80

LABO0335-001 06/01/2005

CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH OF A STRAIGHT LINE MADE BY EXTENDING THE NORTH BOUNDARY LINE OF WAHKIAKUM COUNTY WEST TO THE PACIFIC OCEAN), SKAMANIA AND WAHKIAKUM COUNTIES

	Rates	Fringes

Laborers:
ZONE 1:

GROUP 1	$ 24.22	7.95
GROUP 2	$ 24.78	7.95
GROUP 3	$ 25.20	7.95
GROUP 4	$ 25.56	7.95
GROUP 5	$ 21.86	7.95
GROUP 6	$ 19.58	7.95
GROUP 7	$ 16.57	7.95

Zone Differential (Add to Zone 1 rates):
Zone 2 $ 0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 2.75

BASE POINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city all.
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall.

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Plant Laborers; Asphalt Spreaders; Batch Weighman; Broomers; Brush Burners and Cutters; Car and Truck Loaders; Carpenter Tender; Change-House Man or Dry Shack Man; Choker Setter; Clean-up Laborers; Curing, Concrete; Demolition, Wrecking and Moving Laborers; Dumpers, road oiling crew; Dumpmen (for grading crew); Elevator Feeders; Guard Rail, Median Rail Reference Post, Guide Post, Right of Way Marker; Fine Graders; Fire Watch; Form Strippers (not swinging stages); General Laborers; Hazardous Waste Worker; Leverman or Aggregate Spreader (Flaherty and similar types); Loading Spotters; Material Yard Man (including electrical); Pittsburgh Chipper Operator or Similar Types; Railroad Track Laborers; Ribbon Setters (including steel forms); Rip Rap Man (hand placed); Road Pump Tender; Sewer Labor; Signalman; Skipman; Slopers; Spraymen; Stake Chaser; Stockpiler; Tie Back Shoring; Timber Faller and Bucker (hand labor); Toolroom Man (at job site); Tunnel Bullgang (above ground); Weight-Man- Crusher (aggregate when used)

GROUP 2: Applicator (including pot power tender for same), applying protective material by hand or nozzle on utility lines or storage tanks on project; Brush Cutters (power saw); Burners; Choker Splicer; Clary Power Spreader and similar types; Clean- up Nozzleman-Green Cutter (concrete, rock, etc.); Concrete Power Buggyman; Concrete Laborer; Crusher Feeder; Demolition and Wrecking Charred Materials; Gunite Nozzleman Tender; Gunite or Sand Blasting Pot Tender; Handlers or Mixers of all Materials of an irritating nature (including cement and lime); Tool Operators (includes but not limited to: Dry Pack Machine; Jackhammer; Chipping Guns; Paving Breakers); Pipe Doping and Wrapping; Post Hole Digger, air, gas or electric; Vibrating Screed; Tampers; Sand Blasting (Wet); Stake-Setter; Tunnel-Muckers, Brakemen, Concrete Crew,

Bullgang (underground)

GROUP 3: Asbestos Removal; Bit Grinder; Drill Doctor; Drill Operators, air tracks, cat drills, wagon drills, rubber-mounted drills, and other similar types including at crusher plants; Gunite Nozzleman; High Scalers, Strippers and Drillers (covers work in swinging stages, chairs or belts, under extreme conditions unusual to normal drilling, blasting, barring-down, or sloping and stripping); Manhole Builder; Powdermen; Concrete Saw Operator; Pwdermen; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzlemen; Sand Blasting (Dry); Sewer Timberman; Track Liners, Anchor Machines, Ballast Regulators, Multiple Tampers, Power Jacks, Tugger Operator; Tunnel-Chuck Tenders, Nippers and Timbermen; Vibrator; Water Blaster

GROUP 4: Asphalt Raker; Concrete Saw Operator (walls); Concrete Nozzelman; Grade Checker; Pipelayer; Laser Beam (pipelaying)-applicable when employee assigned to move, set up, align; Laser Beam; Tunnel Miners; Motorman-Dinky Locomotive-Tunnel; Powderman-Tunnel; Shield Operator-Tunnel

GROUP 5: Traffic Flaggers

GROUP 6: Fence Builders

GROUP 7: Landscaping or Planting Laborers

LABO0335-010 06/01/2004

CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH OF A STRAIGHT LINE MADE BY EXTENDING THE NORTH BOUNDARY LINE OF WAHKIAKUM COUNTY WEST TO THE PACIFIC OCEAN), SKAMANIA AND WAHKIAKUM COUNTIES

	Rates	Fringes
Hod Carrier	$ 25.49	7.50

PAIN0005-002 06/01/2005

STATEWIDE EXCEPT CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Painters:		
STRIPERS	$ 23.20	10.20

PAIN0005-004 03/14/2005

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES

	Rates	Fringes
Painter	$ 19.00	6.60

PAIN0005-006 07/01/2004

ADAMS, ASOTIN; BENTON AND FRANKLIN (EXCEPT HANFORD SITE); CHELAN, COLUMBIA, DOUGLAS, FERRY, GARFIELD, GRANT, KITTITAS, LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA,

WHITMAN AND YAKIMA COUNTIES

	Rates	Fringes
Painters:		
Application of Cold Tar Products, Epoxies, Polyure thanes, Acids, Radiation Resistant Material, Water and Sandblasting, Bridges, Towers, Tanks, Stacks, Steeples	$ 19.89	6.43
Brush, Roller, Striping, Steam-cleaning and Spray	$ 18.89	6.43
Lead Abatement, Asbestos Abatement	$ 19.89	6.43
TV Radio, Electrical Transmission Towers	$ 20.64	6.43

*$.70 shall be paid over and above the basic wage rates listed for work on swing stages and high work of over 30 feet.

PAIN0055-002 05/16/2005

CLARK, COWLITZ, KLICKITAT, PACIFIC, SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Painters:		
Brush & Roller	$ 18.03	6.63
High work - All work 60 ft. or higher	$ 18.78	6.63
Spray and Sandblasting	$ 18.63	6.63

PAIN0055-007 06/01/2005

CLARK, COWLITZ, KLICKITAT, SKAMANIA and WAHKIAKUM COUNTIES

	Rates	Fringes
Painters:		
HIGHWAY & PARKING LOT STRIPER	$ 25.49	8.05

PLAS0072-004 06/01/2005

ADAMS, ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, KITTITAS, LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN, AND YAKIMA COUNTIES

	Rates	Fringes
Cement Mason		
ZONE 1:	$ 22.73	7.43

Zone Differential (Add to Zone 1 rate): Zone 2 - $2.00

BASE POINTS: Spokane, Pasco, Moses Lake, Lewiston
Zone 1: 0 - 45 radius miles from the main post office
Zone 2: Over 45 radius miles from the main post office

PLAS0528-001 06/01/2005

CLALLAM, COWLITZ, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON, WAHKIAKUM AND WHATCOM COUNTIES

	Rates	Fringes
Cement Masons:		
CEMENT MASON	$ 29.59	11.52
COMPOSITION, COLOR MASTIC, TROWEL MACHINE, GRINDER, POWER TOOLS, GUNNITE NOZZLE	$ 29.84	11.52

PLAS0555-002 06/01/2005

CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

ZONE 1:

	Rates	Fringes
Cement Masons:		
CEMENT MASONS DOING BOTH COMPOSITION/POWER MACHINERY AND SUSPENDED/HANGING SCAFFOLD	$ 27.89	11.05
CEMENT MASONS ON SUSPENDED, SWINGING AND/OR HANGING SCAFFOLD	$ 27.39	11.05
CEMENT MASONS	$ 26.89	11.05
COMPOSITION WORKERS AND POWER MACHINERY OPERATORS	$ 27.39	11.05

Zone Differential (Add To Zone 1 Rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 3.00

BASE POINTS: BEND, CORVALLIS, EUGENE, MEDFORD, PORTLAND, SALEM, THE DALLES, VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall

PLUM0032-002 01/01/2005

CLALLAM, KING AND JEFFERSON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters	$ 35.63	15.43

PLUM0032-003 01/01/2005

CHELAN, KITTITAS (NORTHERN TIP), DOUGLAS (NORTH), AND OKANOGAN (NORTH) COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 25.88	12.78

PLUM0044-003 06/01/2005

ADAMS (NORTHERN PART), ASOTIN (CLARKSTON ONLY), FERRY (EASTERN PART), LINCOLN, PEND ORIELLE, STEVENS, SPOKANE, AND WHITMAN COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 29.76	11.69

PLUM0082-001 01/01/2005

CLARK (NORTHERN TIP INCLUDING WOODLAND), COWLITZ, GRAYS HARBOR, LEWIS, MASON (EXCLUDING NE SECTION), PACIFIC, PIERCE SKAMANIA, THURSTON AND WAHKIAKUM COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 31.90	13.77

PLUM0265-003 01/01/2005

ISLAND, SKAGIT, SNOHOMISH,SAN JUAN AND WHATCOM COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 31.80	13.77

PLUM0290-003 04/01/2005

CLARK (ALL EXCLUDING NORTHERN TIP INCLUDING CITY OF WOODLAND)

	Rates	Fringes
Plumbers and Pipefitters.....	$ 33.16	15.09

PLUM0598-005 06/01/2005

ADAMS (SOUTHERN PART), ASOTIN (EXCLUDING THE CITY OF CLARKSTON), BENTON, COLUMBIA, DOUGLAS (EASTERN HALF), FERRY (WESTERN PART), FRANKLIN, GARFIELD, GRANT, KITTITAS (ALL BUT NORTHERN TIP), KLICKITAT, LINCOLN (WESTERN PART), OKANOGAN (EASTERN), WALLA WALLA AND YAKIMA COUNTIES

	Rates	Fringes
Plumber.....	$ 32.57	16.61

PLUM0631-001 01/01/2005

MASON (NE SECTION), AND KITSAP COUNTIES

	Rates	Fringes
Plumbers and Pipefitters All new construction, additions, and remodeling		

of commercial building
projects such as: cocktail
lounges and taverns,
professional buildings,
medical clinics, retail
stores, hotels and motels,
restaurants and fast food
types, gasoline service
stations, and car washes
where the plumbing and
mechanical cost of the
project is less than
$100,000.....$ 21.45 5.18
All other work where the
plumbing and mechanical
cost of the project is
$100,000 and over.....$ 30.99 13.77

TEAM0037-002 06/01/2005

CLARK, COWLITZ, KLICKITAT, PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE 1		
GROUP 1	$ 24.65	10.00
GROUP 2	$ 24.77	10.00
GROUP 3	$ 24.90	10.00
GROUP 4	$ 25.16	10.00
GROUP 5	$ 25.38	10.00
GROUP 6	$ 25.54	10.00
GROUP 7	$ 25.74	10.00

Zone Differential (Add to Zone 1 Rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 2.75

BASE POINTS: ASTORIA, THE DALLES, LONGVIEW AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall.

ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.

ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.

ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.

ZONE 5: More than 80 miles from the respective city hall.

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: A Frame or Hydra lifrt truck w/load bearing surface; Articulated Dump Truck; Battery Rebuilders; Bus or Manhaul Driver; Concrete Buggies (power operated); Concrete Pump Truck; Dump Trucks, side, end and bottom dumps,

including Semi Trucks and Trains or combinations there of: up to and including 10 cu. yds.; Lift Jitneys, Fork Lifts (all sizes in loading, unloading and transporting material on job site); Loader and/or Leverman on Concrete Dry Batch Plant (manually operated); Pilot Car; Pickup Truck; Solo Flat Bed and misc. Body Trucks, 0-10 tons; Truck Tender; Truck Mechanic Tender; Water Wagons (rated capacity) up to 3,000 gallons; Transit Mix and Wet or Dry Mix - 5 cu. yds. and under; Lubrication Man, Fuel Truck Driver, Tireman, Wash Rack, Steam Cleaner or combinations; Team Driver; Slurry Truck Driver or Leverman; Tireman

GROUP 2: Boom Truck/Hydra-lift or Retracting Crane; Challenger; Dumpsters or similar equipment all sizes; Dump Trucks/Articulated Dumps 6 cu to 10 cu.; Flaherty Spreader Driver or Leverman; Lowbed Equipment, Flat Bed Semi-trailer or doubles transporting equipment or wet or dry materials; Lumber Carrier, Driver-Straddle Carrier (used in loading, unloading and transporting of materials on job site); Oil Distributor Driver or Leverman; Transit mix and wet or dry mix trcuks: over 5 cu. yds. and including 7 cu. yds.; Vacuum Trucks; Water truck/Wagons (rated capacity) over 3,000 to 5,000 gallons

GROUP 3: Ammonia Nitrate Distributor Driver; Dump trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 10 cu. yds. and including 30 cu. yds. includes Articulated Dump Trucks; Self-Propelled Street Sweeper; Transit mix and wet or dry mix truck: over 7 cu yds. and including 11 cu yds.; Truck Mechanic-Welder-Body Repairman; Utility and Clean-up Truck; Water Wagons (rated capacity) over 5,000 to 10,000 gallons

GROUP 4: Asphalt Burner; Dump Trucks, side, end and bottom cumps, including Semi-Trucks and Trains or combinations thereof: over 30 cu. yds. and including 50 cu. yds. includes Articulated Dump Trucks; Fire Guard; Transit Mix and Wet or Dry Mix Trucks, over 11 cu. yds. and including 15 cu. yds.; Water Wagon (rated capacity) over 10,000 gallons to 15,000 gallons

GROUP 5: Composite Crewman; Dump Trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 50 cu. yds. and including 60 cu. yds. includes Articulated Dump Trucks

GROUP 6: Bulk Cement Spreader w/o Auger; Dry Pre-Batch concrete Mix Trucks; Dump trucks, side, end and bottom dumps, including Semi Trucks and Trains of combinations thereof: over 60 cu. yds. and including 80 cu. yds., and includes Articulated Dump Trucks; Skid Truck

GROUP 7: Dump Trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 80 cu. yds. and including 100 cu. yds., includes Articulated Dump Trucks; Industrial Lift Truck (mechanical tailgate)

TEAM0174-001 06/01/2005

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE A:		
GROUP 1:.....	$ 26.94	11.58
GROUP 2:.....	$ 26.36	11.58
GROUP 3:.....	$ 23.96	11.58
GROUP 4:.....	$ 19.71	11.58
GROUP 5:.....	$ 26.70	11.58

ZONE B (25-45 miles from center of listed cities*): Add $.70 per hour to Zone A rates.
ZONE C (over 45 miles from centr of listed cities*): Add $1.00 per hour to Zone A rates.

*Zone pay will be calculated from the city center of the following listed cities:

BELLINGHAM	CENTRALIA	RAYMOND	OLYMPIA
EVERETT	SHELTON	ANACORTES	BELLEVUE
SEATTLE	PORT ANGELES	MT. VERNON	KENT
TACOMA	PORT TOWNSEND	ABERDEEN	BREMERTON

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - "A-frame or Hydralift" trucks and Boom trucks or similar equipment when "A" frame or "Hydralift" and Boom truck or similar equipment is used; Buggymobile; Bulk Cement Tanker; Dumpsters and similar equipment, Tournorockers, Tournowagon, Tournotrailer, Cat DW series, Terra Cobra, Le Tourneau, Westinghouse, Athye Wagon, Euclid Two and Four-Wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump Trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with 16 yards to 30 yards capacity: Over 30 yards $.15 per hour additional for each 10 yard increment; Explosive Truck (field mix) and similar equipment; Hyster Operators (handling bulk loose aggregates); Lowbed and Heavy Duty Trailer; Road Oil Distributor Driver; Spreader, Flaherty Transit mix used exclusively in heavy construction; Water Wagon and Tank Truck-3,000 gallons and over capacity

GROUP 2 - Bulllifts, or similar equipment used in loading or unloading trucks, transporting materials on job site; Dumpsters, and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat. D.W. Series, Terra Cobra, Le Tourneau, Westinghouse, Athye wagon, Euclid two and four-wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with less than 16 yards capacity; Flatbed (Dual Rear Axle); Grease Truck, Fuel Truck, Greaser, Battery Service Man and/or Tire Service Man; Leverman and loader at bunkers and batch plants; Oil tank transport; Scissor truck; Slurry Truck; Sno-Go and similar equipment; Swampers; Straddler Carrier (Ross, Hyster) and similar equipment; Team Driver; Tractor (small, rubber-tired)(when used within Teamster jurisdiction); Vacuum truck; Water Wagon and Tank trucks-less than 3,000 gallons capacity; Winch Truck; Wrecker, Tow truck and similar equipment

GROUP 3 - Flatbed (single rear axle); Pickup Sweeper; Pickup Truck. (Adjust Group 3 upward by $2.00 per hour for onsite work only)

GROUP 4 - Escort or Pilot Car

GROUP 5 - Mechanic

HAZMAT PROJECTS

Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:
LEVEL C: +$.25 per hour - This level uses an air purifying respirator or additional protective clothing.
LEVEL B: +$.50 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."
LEVEL A: +$.75 per hour - This level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

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* TEAM0760-002 06/01/2005

ADAMS, ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT KITTITAS, LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA COUNTIES

	Rates	Fringes
Truck drivers: (ANYONE WORKING ON HAZMAT JOBS SEE FOOTNOTE A BELOW)		
ZONE 1:		
GROUP 1	$ 17.83	9.90
GROUP 2	$ 20.10	9.90
GROUP 3	$ 20.60	9.90
GROUP 4	$ 20.93	9.90
GROUP 5	$ 21.04	9.90
GROUP 6	$ 21.21	9.90
GROUP 7	$ 21.74	9.90
GROUP 8	$ 22.07	9.90

Zone Differential (Add to Zone 1 rate: Zone 2 - $2.00)

BASE POINTS: Spokane, Moses Lake, Pasco, Lewiston
Zone 1: 0-45 radius miles from the main post office.
Zone 2: Outside 45 radius miles from the main post office

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Escort Driver or Pilot Car; Employee Haul; Power Boat Hauling Employees or Material

GROUP 2: Fish Truck; Flat Bed Truck; Fork Lift (3000 lbs. and under); Leverperson (loading trucks at bunkers); Trailer Mounted Hydro Seeder and Mulcher; Seeder & Mulcher; Stationary Fuel Operator; Tractor (small, rubber-tired, pulling trailer or similar equipment)

GROUP 3: Auto Crane (2000 lbs. capacity); Buggy Mobile & Similar; Bulk Cement Tanks & Spreader; Dumptor (6 yds. & under); Flat Bed Truck with Hydraullic System; Fork Lift

(3001-16,000 lbs.); Fuel Truck Driver, Steamcleaner & Washer; Power Operated Sweeper; Rubber-tired Tunnel Jumbo; Scissors Truck; Slurry Truck Driver; Straddle Carrier (Ross, Hyster, & similar); Tireperson; Transit Mixers & Truck Hauling Concrete (3 yd. to & including 6 yds.); Trucks, side, end, bottom & articulated end dump (3 yards to and including 6 yds.); Warehouseperson (to include shipping & receiving); Wrecker & Tow Truck

GROUP 4: A-Frame; Burner, Cutter, & Welder; Service Greaser; Trucks, side, end, bottom & articulated end dump (over 6 yards to and including 12 yds.); Truck Mounted Hydro Seeder; Warehouseperson; Water Tank truck (0-8,000 gallons)

GROUP 5: Dumptor (over 6 yds.); Lowboy (50 tons & under); Self- loading Roll Off; Semi-Truck & Trailer; Tractor with Steer Trailer; Transit Mixers and Trucks Hauling Concrete (over 6 yds. to and including 10 yds.); Trucks, side, end, bottom and end dump (over 12 yds. to & including 20 yds.); Truck-Mounted Crane (with load bearing surface either mounted or pulled, up to 14 ton); Vacuum Truck (super sucker, guzzler, etc.)

GROUP 6: Flaherty Spreader Box Driver; Flowboys; Fork Lift (over 16,000 lbs.); Dumps (Semi-end); Mechanic (Field); Semi- end Dumps; Transfer Truck & Trailer; Transit Mixers & Trucks Hauling Concrete (over 10 yds. to & including 20 yds.); Trucks, side, end, bottom and articulated end dump (over 20 yds. to & including 40 yds.); Truck and Pup; Tournarocker, DWs & similar with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater Water Tank Truck (8,001- 14,000 gallons); Lowboy(over 50 tons)

GROUP 7: Oil Distributor Driver; Stringer Truck (cable oeprated trailer); Transit Mixers & Trucks Hauling Concrete (over 20 yds.); Truck, side, end, bottom end dump (over 40 yds. to & including 100 yds.); Truck Mounted Crane (with load bearing surface either mounted or pulled (16 through 25 tons);

GROUP 8: Prime Movers and Stinger Truck; Trucks, side, end, bottom and articulated end dump (over 100 yds.); Helicopter Pilot Hauling Employees or Materials

Footnote A - Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in additon to the classification working in as follows:

LEVEL C-D: - $.50 PER HOUR (This is the lowest level of protection. This level may use an air purifying respirator or additional protective clothing.

LEVEL A-B: - $1.00 PER HOUR (Uses supplied air is conjunction with a chemical spash suit or fully encapsulated suit with a self-contained breathing apparatus.

Employees shall be paid Hazmat pay in increments of four(4) and eight(8) hours.

NOTE:
Trucks Pulling Equipment Trailers: shall receive $.15/hour over applicable truck rate

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour DivisioN
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material,

etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

General Decision Number: WA030002 07/29/2005 WA2

Superseded General Decision Number: WA020002

State: Washington

Construction Type: Building

Counties: Chelan, Clallam, Grays Harbor, Jefferson, King, Kitsap, Kittitas, Lewis, Mason, Pacific, Pierce, Snohomish and Thurston Counties in Washington.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	06/13/2003
1	02/06/2004
2	02/13/2004
3	03/05/2004
4	03/12/2004
5	05/14/2004
6	06/18/2004
7	06/25/2004
8	07/02/2004
9	07/23/2004
10	08/06/2004
11	08/20/2004
12	09/03/2004
13	10/01/2004
14	10/15/2004
15	10/22/2004
16	11/05/2004
17	11/19/2004
18	12/03/2004
19	01/14/2005
20	02/11/2005
21	02/18/2005
22	03/04/2005
23	03/18/2005
24	03/25/2005
25	04/01/2005
26	04/22/2005
27	06/03/2005
28	06/10/2005
29	06/17/2005
30	07/08/2005
31	07/29/2005

* ASBE0007-001 06/01/2005

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coating and finishes to all types of mechanical systems)	$ 32.72	10.21

BOIL0242-003 01/01/2005

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Boilermaker	$ 27.35	17.62

BOIL0502-001 01/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Boilermaker	$ 27.35	17.62

BRWA0001-001 06/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (northern part), PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Bricklayer	$ 30.21	10.96

BRWA0001-005 06/01/2005

PACIFIC COUNTY (SOUTHERN PART)

	Rates	Fringes
Bricklayer	$ 28.92	11.35
Marble Mason	$ 29.92	11.35

BRWA0001-006 05/01/2005

PACIFIC (SOUTHERN PORTION) COUNTY

	Rates	Fringes
Terrazzo Worker & Tile Setter	$ 25.13	9.60
Tile & Terrazzo Finisher	$ 18.81	7.30

BRWA0001-007 06/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP,LEWIS, MASON, PACIFIC (NORTHERN HALF), PIERCE, THURSTON AND SNOHOMISH COUNTIES

	Rates	Fringes
Tile & Terrazzo Finisher	$ 22.00	10.26
Tile & Terrazzo Worker	$ 27.72	10.71

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* BRWA0003-001 06/01/2005

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Bricklayer	$ 23.71	9.71

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* BRWA0003-005 06/01/2005

CHELAN AND KITTITAS

	Rates	Fringes

Tile & Terrazzo Finisher.....$ 15.05 7.63

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* BRWA0003-006 06/01/2005

CHELAN AND KITTITAS

	Rates	Fringes
Tile Layer/Terrazzo Worker.....	$ 18.85	7.63

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* CARP0770-004 06/01/2005

	Rates	Fringes
Carpenters:		
CENTRAL WASHINGTON: CHELAN AND KITTITAS COUNTIES		
ACCOUSTICAL WORKERS.....	$ 21.71	10.45
CARPENTERS AND DRYWALL APPLICATORS.....	$ 21.45	10.45
CARPENTERS ON CREOSOTED MATERIALS.....	$ 21.55	10.45
DIVERS TENDER.....	$ 32.26	10.67
DIVERS.....	$ 72.52	10.67
INSULATION APPLICATORS.....	$ 21.45	10.45
MILLWRIGHTS AND MACHINE ERECTORS.....	$ 30.40	10.45
PILDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING, OR CREOSOTE TREATED MATERIAL, ALL PILING.....	$ 29.60	10.45
PILEDRIVER, BRIDGE DOCK & WHARF CARPENTERS.....	$ 29.40	10.45
SAWFILER, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLERS, FLOOR SANDER OPERATOR AND OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS.....	$ 21.58	10.45

(HOURLY ZONE PAY:WESTERN WASHINGTON AND CENTRAL WASHINGTON CARPENTERS ONLY)

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
25-35 radius miles	$1.00/hour
35-45 radius miles	$1.15/hour

45-55 radius miles $1.35/hour
Over 55 radius miles $1.55/hour

(HOURLY ZONE PAY:WESTERN AND CENTRAL WASHINGTON-MILLWRIGHTS AND PILEDRIVERS ONLY)

Hour Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
25-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

Millwrights and Piledrivers who reside in Aberdeen, Bellingham, Port Angeles, Mount Vernon, Olympia, Wenatchee, or Yakima Local Union jurisdication areas, working on jobs in their respective area, shall have their Zone Pay measured from their respective city center

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* CARP0770-007 06/01/2005

	Rates	Fringes
Carpenters:		
WESTERN WASHINGTON: CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTH), PIERCE, SNOHOMISH AND THURSTON COUNTIES		
ACOUSTICAL WORKERS	$ 29.56	10.67
BRIDGE, DOCK & WHARF CARPENTERS	$ 29.40	10.67
CARPENTERS AND DRYWALL APPLICATORS	$ 29.40	10.67
CARPENTERS ON CREOSOTE MATERIAL	$ 29.50	10.67
DIVERS TENDER	$ 32.26	10.67
DIVERS	$ 72.52	10.67
INSULATION APPLICATORS	$ 29.40	10.67
MILLWRIGHT AND MACHINE ERECTORS	$ 30.40	10.67
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED MATERIAL, ALL PILING	$ 29.60	10.67
SAWFILERS, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLER, FLOOR SANDER OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS	$ 29.53	10.67

(HOURLY ZONE PAY:WESTERN WASHINGTON AND CENTRAL WASHINGTON CARPENTERS ONLY)

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle Olympia Bellingham

Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
25-35 radius miles	$1.00/hour
35-45 radius miles	$1.15/hour
45-55 radius miles	$1.35/hour
Over 55 radius miles	$1.55/hour

(HOURLY ZONE PAY:WESTERN AND CENTRAL WASHINGTON-MILLWRIGHTS AND PILEDRIVERS ONLY)

Hour Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
25-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

Millwrights and Piledrivers who reside in Aberdeen, Bellingham, Port Angeles, Mount Vernon, Olympia, Wenatchee, or Yakima Local Union jurisdication areas, working on jobs in their respective area, shall have their Zone Pay measured from their respective city center

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CARP9003-001 06/01/2005

PACIFIC COUNTY (South of a straight line made by extending the north boundary line of Wahkiakum County west to Willapa Bay to the Pacific Ocean, and thence north through the natural waterway to the Pacific Ocean (this will include the entire peninsula west of Willapa Bay)

SEE ZONE DESCRIPTION FOR CITIES BASE POINTS

ZONE 1:

	Rates	Fringes
Carpenters:		
CARPENTERS	$ 28.41	11.16
DIVERS TENDERS	$ 31.01	11.16
DIVERS	$ 67.18	11.16
DRYWALL, ACOUSTICAL & LATHERS	$ 28.41	11.16
FLOOR LAYERS & FLOOR FINISHERS (the laying of all hardwood floors nailed and mastic set, parquet and wood-type tiles, and block floors, the sanding and finishing of floors, the prepara- tion of old and new floors when the materials mentioned above are to be installed;		
INSULATORS (fiberglass and similar irritating material)	$ 28.56	11.16

MILLWRIGHTS.....$ 28.91 11.16
PILEDRIVERS.....$ 28.91 11.16

Zone Differential (Add to Zone 1 rates):
Zone 2 - $0.85
Zone 3 - 1.25
Zone 4 - 1.70
Zone 5 - 2.00
Zone 6 - 3.00

BASEPOINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects located within 30 miles of the respective city hall of the above mentioned cities

ZONE 2: Projects located more than 30 miles and less than 40 miles of the respective city of the above mentioned cities

ZONE 3: Projects located more than 40 miles and less than 50 miles of the respective city of the above mentioned cities

ZONE 4: Projects located more than 50 miles and less than 60 miles of the respective city of the above mentioned cities.

ZONE 5: Projects located more than 60 miles and less than 70 miles of the respective city of the above mentioned cities

ZONE 6: Projects located more than 70 miles of the respected city of the above mentioned cities

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* ELEC0046-002 06/06/2005

CALLAM, JEFFERSON, KING AND KITSAP COUNTIES

	Rates	Fringes
Cable splicer	$ 36.85	3%+12.64
Electrician	$ 33.50	3%+12.64

ELEC0046-003 08/02/2004

CALLAM, JEFFERSON, KING, KITSAP COUNTIES

	Rates	Fringes
Sound & Communication Technician	$ 21.59	5.54

SCOPE OF WORK:

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, fire alarms and life safety systems (hang, terminate devices and panels and to conduct functional and systems tests), and low voltage master clock systems. Install chases and/or nipples, not to exceed ten (10) feet, on systems not in

conduit.

WORK EXCLUDED:

Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (over 10 feet) may be installed on open wiring systems.

ELEC0076-001 09/01/2004

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE, THURSTON COUNTIES

	Rates	Fringes
Cable splicer	$ 34.13	3%+12.56
Electrician	$ 30.75	3%+12.56

ELEC0076-003 06/01/2001

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Sound & Communication Technician	$ 18.77	5.97

SCOPE OF WORK

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems: SCADA (Supervisory control/data acquisition PCM (Pulse code modulation) Inventory control systems Digital data systems Broadband & baseband and carriers Point of sale systems VSAT data systems Data communication systems RF and remote control systems Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems: Background-Foreground Music Intercom and Telephone Interconnect Systems Sound and Musical Entertainment Systems Nurse Call Systems Radio Page Systems School Intercom and Sound Systems Burglar Alarm Systems Low-Voltage Master Clock Systems Multi-Media/Multiplex Systems Telephone Systems RF Systems and Antennas and Wave Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video

Entertainment Systems Video Educational Systems Microwave Transmission Systems CATV and CCTV

E. Security Systems: Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.
3. Make all low voltage wire terminations that are properly seperated from the line voltage side.
4. Install any panel or equipment the contains only low voltage control elements, but has line voltage as a power source.
5. Install chases and /or nipples, not to exceed ten (10) feet, on sytems not in conduit.
6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:
1. Fire Alarms-In Raceways
a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.
b. Installation and termination of devices, panels, startup, testing and programming performed by the technician.

2. Fire Alarms-Open Wire Systems
a. Open wire systems installed by the technician.

ELEC0112-002 06/01/2005

KITTITAS COUNTY

	Rates	Fringes
Cable splicer	$ 31.40	3%+12.43
Electrician	$ 29.90	3%+12.43

ELEC0112-007 06/01/2002

KITTTITAS COUNTY

	Rates	Fringes
Sound & Communication Technician	$ 19.97	5.93

SCOPE OF WORK

The work covered shall include the installation, testing, service and maintenance, of the following systems that utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for TV monitoring and surveillance, background foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above

listed systems: SCADA (Supervisory control/data acquisition PCM (Pulse code modulation) Inventory control systems Digital data systems Broadband & baseband and carriers Point of sale systems VSAT data systems Data communication systems RF and remote control systems Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems: Background-Foreground Music Intercom and Telephone Interconnect Systems Sound and Musical Entertainment Systems Nurse Call Systems Radio Page Systems School Intercom and Sound Systems Burglar Alarm Systems Low-Voltage Master Clock Systems Multi-Media/Multiplex Systems Telephone Systems RF Systems and Antennas and Wave Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video Entertainment Systems Video Educational System Microwave Transmission Systems CATV and CCTV

E. Security Systems: Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.
3. Make all low voltage wire terminations that are properly seperated from the line voltage side.
4. Install any panel or equipment the contains only low voltage control elements, but has line voltage as a power source.
5. Install chases and /or nipples, not to exceed ten (10) feet, on sytems not in conduit.
6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:
1. Fire Alarms-In Raceways
a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.
b. Installation and termination of devices, panels, startup, testing and programing performed by the technician.

2. Fire Alarms-Open Wire Systems
a. Open wire systems installed by the technician.

ELEC0191-001 09/01/2004

CHELAN COUNTY

	Rates	Fringes
Cable splicer	$ 29.33	3%+10.28
Electrician	$ 26.66	3%+10.28

ELEC0191-005 06/01/2003

CHELAN AND SNOHOMISH COUNTIES

	Rates	Fringes
Sound & Communication Technician.....	$ 22.50	4.87

SCOPE OF WORK

The work covered shall include the installation, testing, service and maintenance, of the following systems that utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for TV monitoring and surveillance, background foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems: SCADA (Supervisory control/data acquisition PCM (Pulse code modulation) Inventory control systems Digital data systems Broadband & baseband and carriers Point of sale systems VSAT data systems Data communication systems RF and remote control systems Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems: Background-Foreground Music Intercom and Telephone Interconnect Systems Sound and Musical Entertainment Systems Nurse Call Systems Radio Page Systems School Intercom and Sound Systems Burglar Alarm Systems Low-Voltage Master Clock Systems Multi-Media/Multiplex Systems Telephone Systems RF Systems and Antennas and Wave Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video Entertainment Systems Video Educational Systems Microwave Transmission Systems CATV and CCTV

E. Security Systems:
Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.
3. Make all low voltage wire terminations that are properly seperated from the line voltage side.
4. Install any panel or equipment the contains only low voltage control elements, but has line voltage as a power source.
5. Install chases and /or nipples, not to exceed ten (10) feet, on sytems not in conduit.
6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:
1. Fire Alarms-In Raceways
  a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.
  b. Installation and termination of devices, panels, startup, testing and programming performed by the technician.

2. Fire Alarms-Open Wire Systems
     a. Open wire systems installed by the tchnician.

ELEC0191-010 09/01/2004

SNOHOMISH COUNTY

	Rates	Fringes
Cable splicer	$ 33.72	3%+10.33
Electrician	$ 30.66	3%+10.33

ELEV0019-001 01/01/2005

CHELAN, CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, KITTITAS, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Elevator Mechanic	$ 37.08	12.015 + A

FOOTNOTE: a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit. Seven paid holidays: New Year's Day; Memorial Day; Independence Day; Labor Day, Thanksgiving Day; Friday after Thanksgiving and Christmas Day

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ELEV0023-002 01/01/2005

PACIFIC COUNTY

	Rates	Fringes
Elevator Mechanic	$ 37.26	12.015+a

FOOTNOTE
  a: Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day, and New Years Day.

ENGI0302-001 06/01/2005

CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, KITTITAS, MASON AND SNOHOMISH COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 95% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes

Power equipment operators:

Group 1A	$ 31.08	11.05
Group 1AA	$ 31.63	11.05
Group 1AAA	$ 32.17	11.05
Group 1	$ 30.54	11.05
Group 2	$ 30.07	11.05
Group 3	$ 29.66	11.05
Group 4	$ 27.37	11.05

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) - $ .70
Zone 3 (Over 45 radius miles) - $1.00

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead 6 yards to, but not including 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9, HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self propelled 45 yards and over; Slipform pavers; Transporters, all truck or track type

GROUP 2 - Barrier machine (zipper); Batch Plant Operaor-Concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons; Chipper; Concrete Pump-truck mount with boom attachment; Crusher; Deck Engineer/Deck Winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing Machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Horizontal/directional drill operator; Loaders-overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics-all; Mixers-asphalt plant; Motor patrol graders-finishing; Piledriver (other than crane mount); Roto-mill,roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrade trimmer; Tractors, backhoes-over 75 hp; Transfer material service machine-shuttle buggy, blaw knox-roadtec; Truck crane oiler/driver-100 tons and over; Truck Mount portable conveyor; Yo Yo Pay dozer

GROUP 3 - Conveyors; Cranes-thru 19 tons with attachments; A-frame crane over 10 tons; Drill oilers-auger type, truck or crane mount; Dozers-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loader-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pumps-concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrpers-concrete and carry-all; Service engineer-equipment; Trenching machines; Truck Crane Oiler/Driver under 100 tons; Tractors, backhoe 75 hp and under

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete finish mahine-laser screed; Cranes-A frame-10 tons and under; Elevator and Manlift-permanent or shaft type; Gradechecker, Stakehop; Forklifts under 3000 lbs. with attachments; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger, mechanical; Power plant; Pumps, water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than $1 million where no building is involved. Surfacing and paving including, but utilities excluded.
3. Marine projects (docks, wharfs, ect.) less than $150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designed hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing.
H-2 Class "C" Suit - Base wage rate plus $.25 per hour.
H-3 Class "B" Suit - Base wage rate plus $.50 per hour.
H-4 Class "A" Suit - Base wage rate plus $.75 per hour.

ENGI0370-008 06/01/2005

CHELAN (EAST OF THE 120TH MERIDIAN) COUNTY

ZONE 1:

	Rates	Fringes
Power equipment operators:		
GROUP 1A	$ 20.89	7.87
GROUP 1	$ 21.44	7.87
GROUP 2	$ 21.76	7.87
GROUP 3	$ 22.37	7.87
GROUP 4	$ 22.53	7.87
GROUP 5	$ 22.69	7.87
GROUP 6	$ 22.97	7.87

GROUP 7.....$ 23.24 7.87
GROUP 8.....$ 24.34 7.87

ZONE DIFFERENTIAL (Add to Zone 1 rate):
Zone 2 - $2.00

Zone 1: Within 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho
Zone 2: Outside 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1A: Boat Operator; Crush Feeder; Oiler; Steam Cleaner

GROUP 1: Bit Grinders; Bolt Threading Machine; Compressors (under 2000 CFM, gas, diesel, or electric power); Deck Hand; Drillers Helper (assist driller in making drill rod connections, service drill engine and air compressor, repair drill rig and drill tools; drive drill support truck to and on the job site, remove drill cuttings from around bore hole and inspect drill rig while in operation); Fireman & Heat Tender; Grade Checker; Hydro- seeder, Mulcher, Nozzleman; Oiler Driver, & Cable Tender, Mucking Machine; Pumpman; Rollers, all types on subgrade, including seal and chip coatings (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by Dozer with operable blade; Welding Machine

GROUP 2: A-frame Truck (single drum); Assistant Refrigeration Plant (under 1000 ton); Assistant Plant Operator, Fireman or Pugmixer (asphalt); Bagley or Stationary Scraper; Belt Finishing Machine; Blower Operator (cement); Cement Hog; Compressor (2000 CFM or over, 2 or more, gas diesel or electric power); Concrete Saw (multiple cut); Distributor Leverman; Ditch Witch or similar; Elevator Hoisting Materials; Dope Pots (power agitated); Fork Lift or Lumber Stacker, hydra-lift & similar; Gin Trucks (pipeline); Hoist, single drum; Loaders (bucket elevators and conveyors); Longitudinal Float; Mixer (portable-concrete); Pavement Breaker, Hydra-Hammer & similar; Power Broom; Railroad Ballast Regulation Operator (self-propelled); Railroad Power Tamper Operator (self-propelled); Railroad Tamper Jack Operator (self-propelled; Spray Curing Machine (concrete); Spreader Box (self-propelled); Straddle Buggy (Ross & similar on construction job only); Tractor (Farm type R/T with attachment, except Backhoe); Tugger Operator

GROUP 3: A-frame Truck (2 or more drums); Assistant Refrigeration Plant & Chiller Operator (over 1000 ton); Backfillers (Cleveland & similar); Batch Plant & Wet Mix Operator, single unit (concrete); Belt-Crete Conveyors with power pack or similar; Belt Loader (Kocal or similar); Bending Machine; Bob Cat; Boring Machine (earth); Boring Machine (rock under 8 inch bit) (Quarry Master, Joy or similar); Bump Cutter (Wayne, Saginau or similar); Canal Lining Machine (concrete); Chipper (without crane); Cleaning & Doping Machine (pipeline); Deck Engineer; Elevating Belt-type Loader (Euclid, Barber Green & similar); Elevating Grader-type Loader (Dumor, Adams or similar); Generator Plant Engineers (diesel or electric); Gunnite Combination Mixer & Compressor; Locomotive Engineer; Mixermobile; Mucking Machine; Posthole Auger or Punch; Pump (grout or jet); Soil Stabilizer (P & H or

similar); Spreader Machine; Tractor (to D-6 or equivalent) and Traxcavator; Traverse Finish Machine; Turnhead Operator

GROUP 4: Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman & similar); Curb Extruder (asphalt or concrete); Drills (churn, core, calyx or diamond)(Operate drilling machine, drive or transport drill rig to and on job site and weld well casing); Equipment Serviceman, Greaser & Oiler; Hoist (2 or more drums or Tower Hoist); Loaders (overhead & front-end, under 4 yds. R/T); Refrigeration Plant Engineer (under 1000 ton); Rubber-tired Skidders (R/T with or without attachments); Surface Heater & Planer Machine; Trenching Machines (under 7 ft. depth capacity); Turnhead (with re-screening); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (under 45,000 gw); Backhoe and Hoe Ram (under 3/4 yd.); Carrydeck & boom truck (under 25 tons); Cranes (25 tons & under),all attachments including clamshell, dragline); Derricks & Stifflegs (under 65 tons); Drilling Equipment (8 inch bit & over) (Robbins, reverse circulation & similar)(operates drill machine, drive or transport drill rig to and on job site and weld well casing); Hoe Ram; Piledriving Engineers; Paving (dual drum); Railroad Track Liner Operator(self-propelled); Refrigeration Plant Engineer (1000 tons & over); Signalman (Whirleys, Highline Hammerheads or similar)

GROUP 6: Asphalt Plant Operator; Automatic Subgrader (Ditches & Trimmers) (Autograde, ABC, R.A. Hansen & similar on grade wire); Backhoe (45,000 gw and over to 110,000 gw); Backhoes & Hoe Ram (3/4 yd. to 3 yd.); Batch Plant (over 4 units); Batch & Wet Mix Operator (multiple units, 2 & incl. 4); Blade Operator (Motor Patrol & Attachments, Athey & Huber); Boom Cats (side); Cableway Controller (dispatcher); Clamshell Operator (under 3 yds.); Compactor (self-propelled with blade); Concrete Pump Boom Truck; Concrete Slip Form Paver; Cranes (over 25 tons including 45 tons), all attachments including clamshell, dragline; Crusher, Grizzle & Screening Plant Operator; Dozer, 834 R/T & similar; Draglines (under 3 yds.); Drill Doctor; H.D.Mechanic; H.D. Welder; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.), Multiple Dozer Units with single blade; Paving Machine (asphalt and concrete); Quad-Track or similar equipment; Rollerman (finishing asphalt pavement); Roto Mill (pavement grinder); Scrapers, all rubber-tired; Screed Operator; Shovel (under 3 yds.); Tractors (D-6 & equilvalent & over); Trenching Machines (7 ft. depth & over); Tug Boat Operator; Vactor Guzzler, super sucker

GROUP 7: Backhoe (over 110,000 gw); Backhoes & Hoe Ram (3 yds. & over); Blade (finish & bluetop), Automatic, CMI, ABC, Finish Athey & Huber & similar when used as automatic; Cableway Operators; Clamshell Operator (3 yds. & over); Cranes (over 45 tons to but not including 85 tons), all attachments including clamshell and dragline; Derricks & Stifflegs (65 tons & over); Draglines (3 yds. & over); Elevating Belt (Holland type); Heavy Equipment Robotics Operator; Loader (360 degrees revolving Koehring Scooper or similar); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Shovels (3 yds. & over); Ultra High Pressure Wateriet Cutting Tool System Operator (30,000

psi); Vacuum Blasting Machine Operator; Whirleys & Hammerheads, ALL

GROUP 8: Cranes (85 tons and over, and all climbing, overhead, rail and tower); Loaders (overhead and front-end, 10 yards and over); Helicopter Pilot

BOOM PAY: (All Cranes, Including Tower

180 ft to 250 ft	$.30 over scale
Over 250 ft	$.60 over scale

NOTE:
In computing the length of the boom on Tower Cranes, they shall be measured from the base of the tower to the point of the boom.

HAZMAT: Anyone working on HAZMAT jobs, working with supplied air shall receive $1.00 an hour above classification.

ENGI0612-002 06/01/2005

LEWIS, PIERCE, PACIFIC (portion lying north of a parallel line extending west from the northern boundary of Wahkaikum County to the sea) AND THURSTON COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes
Power equipment operators:		
GROUP 1A	$ 31.08	11.05
GROUP 1AA	$ 31.63	11.05
GROUP 1AAA	$ 32.17	11.05
GROUP 1	$ 30.54	11.05
GROUP 2	$ 30.07	11.05
GROUP 3	$ 29.66	11.05
GROUP 4	$ 27.37	11.05

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) = $ .70
Zone 3 (Over 45 radius miles) - $1.00

BASEPOINTS: CENTRALIA, OLYMPIA, TACOMA

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1 AAA - Cranes-over 300 tons or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes- 200 tonsto 300 tons, or 250 ft of boom (including jib with attachments; Tower crane over 175 ft in height, bas to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons under 150 ft

of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead, 6 yards to, but not including, 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9 HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self-propelled 45 yards and over; Slipform pavers; Transporters, all track or truck type

GROUP 2 - Barrier machine (zipper); Batch Plant Operator-concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-Overhead, bridge type, 20 tons through 44 tons; Chipper; Concrete pump-truck mount with boom attachment; Crusher; Deck engineer/deck winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Loaders, overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics- all; Mixers, asphalt plant; Motor patrol graders, finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self- propelled, hard tail end dump, articulating off-road equipment- under 45 yards; Subgrader trimmer; Tractors, backhoe over 75 hp; Transfer material service machine-shuttle buggy, Blaw Knox- Roadtec; Truck Crane oiler/driver-100 tons and over; Truck Mount Portable Conveyor; Yo Yo pay

GROUP 3 - Conveyors; Cranes through 19 tons with attachments; Crane-A-frame over 10 tons; Drill oilers-auger type, truck or crane mount; Dozer-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside Hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loaders-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pump-Concrete; Roller, plant mix or multi-lfit materials; Saws-concrete; Scrapers, concrete and carry all; Service engineers-equipment; Trenching machines; Truck crane oiler/driver under 100 tons; Tractors, backhoe under 75 hp

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete Finish Machine-laser screed; Cranes A-frame 10 tons and under; Elevator and manlift (permanent and shaft type); Forklifts-under 3000 lbs. with attachments; Gradechecker, stakehop; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger-mechanical; Power plant; Pumps-water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.

2. Projects of less than $1 million where no building is involved. Surfacing and paving included, but utilities excluded.

3. Marine projects (docks, wharfs, etc.) less than $150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing
H-2 Class "C" Suit - Base wage rate plus $ .25 per hour.
H-3 Class "B" Suit - Base wage rate plus $ .50 per hour.
H-4 Class "A" Suit - Base wage rate plus $ .75 per hour.

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PACIFIC (remaining portion) COUNTY

	Rates	Fringes
Power equipment operators: (See Footnote A)		
GROUP 1	$ 30.44	9.95
GROUP 1A	$ 31.96	9.95
GROUP 1B	$ 33.48	9.95
GROUP 2	$ 29.14	9.95
GROUP 3	$ 28.34	9.95
GROUP 4	$ 27.78	9.95
GROUP 5	$ 27.15	9.95
GROUP 6	$ 24.66	9.95

Zone Differential (add to Zone 1 rates):
Zone 2 - $1.50
Zone 3 - 3.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or porjects located in Clark & Cowlitz County, Washington except that portion of Cowlitz County in the Mt. St. Helens "Blast Zone" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: CONCRETE: Batch Plant and/or Wet Mix Operator, three units or more; CRANE: Helicopter Operator, when used in erecting work; Whirley Operator, 90 ton and over; LATTICE BOOM CRANE: Operator 200 tons through 299 tons, and/or over 200 feet boom; HYDRAULIC CRANE: Hydraulic Crane Operator 90 tons through 199 tons with luffing or tower attachments; FLOATING EQUIPMENT: Floating Crane, 150 ton but less than 250 ton

GROUP 1A: HYDRAULIC CRANE: Hydraulic Operator, 200 tons and over (with luffing or tower attachment); LATTICE BOOM CRANE: Operator, 200 tons through 299 tons, with over 200 feet boom; FLOATING EQUIPMENT: Floating Crane 250 ton and over

GROUP 1B: LATTICE BOOM CRANE: Operator, 300 tons through 399 tons with over 200 feet boom; Operator 400 tons and over; FLOATING EQUIPMENT: Floating Crane 350 ton and over

GROUP 2: ASPHALT: Asphalt Plant Operator (any type); Roto Mill, pavement profiler, operator, 6 foot lateral cut and over; BLADE: Auto Grader or "Trimmer" (Grade Checker required); Blade Operator, Robotic; BULLDOZERS: Bulldozer operator over 120,000 lbs and above; Bulldozer operator, twin engine; Bulldozer Operator,tandem, quadnine, D10, D11, and similar type; Bulldozere Robotic Equipment (any type; CONCRETE: Batch Plant and/or Wet Mix Operator, one and two drum; Automatic Concrete Slip Form Paver Operator; Concrete Canal Line Operator; Concrete Profiler, Diamond Head; CRANE: Cableway Operator, 25 tons and over; HYDRAULIC CRANE: Hydraulic crane operator 90 tons through 199 tons (with luffing or tower attachment); TOWER/WHIRLEY OPERATOR: Tower Crane Operator; Whirley Operator, under 90 tons; LATTICE BOOM CRANE: 90 through 199 tons and/or 150 to 200 feet boom; CRUSHER: Crusher Plant Operator; FLOATING EQUIPMENT: Floating Clamshell, etc.operator, 3 cu. yds. and over; Floating Crane (derrick barge) Operator, 30 tons but less than 150 tons; LOADERS: Loader operator, 120,000 lbs. and above; REMOTE CONTROL: Remote controlled earth-moving equipment; RUBBER-TIRED SCRAPERS: Rubber-tired scraper operator, with tandem scrapers, multi-engine; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Shovel, Dragline, Clamshell, operator 5 cu. yds and over; TRENCHING MACHINE: Wheel Excavator, under 750 cu. yds. per hour (Grade Oiler required); Canal Trimmer (Grade Oiler required); Wheel Excavator, over 750 cu. yds. per hour; Band Wagon (in conjunction with wheel excavator); UNDERWATER EQUIPMENT: Underwater Equipment Operator, remote

or otherwise; HYDRAULIC HOES-EXCAVATOR: Excavator over 130,000 lbs.

GROUP 3: BULLDOZERS: Bulldozer operator, over 70,000 lbs. up to and including 120,000 lbs.; HYDRAULIC CRANE: Hydraulic crane operator, 50 tons through 89 tons (with luffing or tower attachment); LATTICE BOOM CRANES: Lattice Boom Crane-50 through 89 tons (and less than 150 feet boom); FORKLIFT: Rock Hound Operator; HYDRAULIC HOES-EXCAVATOR: excavator over 80,000 lbs. through 130,000 lbs.; LOADERS: Loader operator 60,000 and less than 120,000; RUBBER-TIRED SCRAPERS: Scraper Operator, with tandem scrapers; Self-loading, paddle wheel, auger type, finish and/or 2 or more units; SHOVEL, DRAGLINE, CLAMSHELL,SKOOPER OPERATOR: Shovel, Dragline, Clamshell operators 3 cu. yds. but less than 5 cu yds.

GROUP 4: ASPHALT: Screed Operator; Asphalt Paver operator (screeman required); BLADE: Blade operator; Blade operator, finish; Blade operator, externally controlled by electronic, mechanical hydraulic means; Blade operator, multi-engine; BULLDOZERS: Bulldozer Operator over 20,000 lbs and more than 100 horse up to 70,000 lbs; Drill Cat Operator; Side-boom Operator; Cable-Plow Operator (any type); CLEARING: Log Skidders; Chippers; Incinerator; Stump Splitter (loader mounted or similar type); Stump Grinder (loader mounted or similar type; Tub Grinder; Land Clearing Machine (Track mounted forestry mowing & grinding machine); Hydro Axe (loader mounted or similar type); COMPACTORS SELF-PROPELLED: Compactor Operator, with blade; Compactor Operator, multi-engine; Compactor Operator, robotic; CONCRETE: Mixer Mobile Operator; Screed Operator; Concrete Cooling Machine Operator; Concrete Paving Road Mixer; Concrete Breaker; Reinforced Tank Banding Machine (K-17 or similar types); Laser Screed; CRANE: Chicago boom and similar types; Lift Slab Machine Operator; Boom type lifting device, 5 ton capacity or less; Hoist Operator, two (2) drum; Hoist Operator, three (3) or more drums; Derrick Operator, under 100 ton; Hoist Operator, stiff leg, guy derrick or similar type, 50 ton and over; Cableway Operator up to twenty (25) ton; Bridge Crane Operator, Locomotive, Gantry, Overhead; Cherry Picker or similar type crane; Carry Deck Operator; Hydraulic Crane Operator, under 50 tons; LATTICE BOOM CRANE OPERATOR: Lattice Boom Crane Operator, under 50 tons; CRUSHER: Generator Operator; Diesel-Electric Engineer; Grizzley Operator; Drill Doctor; Boring Machine Operator; Driller-Percussion, Diamond, Core, Cable, Rotary and similar type; Cat Drill (John Henry); Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Diesel-electric Engineer; Jack Operator, elevating barges, Barge Operator, self-unloading; Piledriver Operator (not crane type) (Deckhand required); Floating Clamshelll, etc. Operator, under 3 cu. yds. (Fireman or Diesel-Electric Engineer required); Floating Crane (derrick barge) Operator, less than 30 tons; GENERATORS: Generator Operator; Diesel-electric Engineer; GUARDRAIL EQUIPMENT: Guardrail Punch Operator (all types); Guardrail Auger Operator (all types); Combination Guardrail machines, i.e., punch auger, etc.; HEATING PLANT: Surface Heater and Planer Operator; HYDRAULIC HOES EXCAVATOR: Robotic Hydraulic backhoe operator, track and wheel type up to and including 20,0000 lbs. with any or all attachments; Excavator Operator over 20,000 lbs through 80,000 lbs.; LOADERS: Belt Loaders, Kolman and Ko Cal types; Loaders

Operator, front end and overhead, 25,000 lbs and less than 60,000 lbs; Elevating Grader Operator by Tractor operator, Sierra, Euclid or similar types; PILEDRIVERS: Hammer Operator; Piledriver Operator (not crane type); PIPELINE, SEWER WATER: Pipe Cleaning Machine Operator; Pipe Doping Machine Operator; Pipe Bending Machine Operator; Pipe Wrapping Machine Operator; Boring Machine Operator; Back Filling Machine Operator; REMOTE CONTROL: Concrete Cleaning Decontamination Machine Operator; Ultra High Pressure Water Jet Cutting Tool System Operator/Mechanic; Vacuum Blasting Machine Operator/mechanic; REPAIRMEN, HEAVY DUTY: Diesel Electric Engineer (Plant or Floating; Bolt Threading Machine operator; Drill Doctor (Bit Grinder); H.D. Mechanic; Machine Tool Operator; RUBBER-TIRED SCRAPERS: Rubber-tired Scraper Operator,single engine, single scraper; Self-loading, paddle wheel, auger type under 15 cu. yds.; Rubber-tired Scraper Operator, twin engine; Rubber-tired Scraper Operator, with push- ull attachments; Self Loading, paddle wheel, auger type 15 cu. yds. and over, single engine; Water pulls, water wagons; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Diesel Electric Engineer; Stationay Drag Scraper Operator; Shovel, Dragline, Clamshell, Operator under 3 cy yds.; Grade-all Operator; SURFACE (BASE) MATERIAL: Blade mounted spreaders, Ulrich and similar types; TRACTOR-RUBBERED TIRED: Tractor operator, rubber-tired, over 50 hp flywheel; Tractor operator, with boom attachment; Rubber-tired dozers and pushers (Michigan, Cat, Hough type); Skip Loader, Drag Box; TRENCHING MACHINE: Trenching Machine operator, digging capacity over 3 ft depth; Back filling machine operator; TUNNEL: Mucking machine operator

GROUP 5: ASPHALT: Extrusion Machine Operator; Roller Operator (any asphalt mix); Asphalt Burner and Reconditioner Operator (any type); Roto-Mill, pavement profiler, ground man; BULLDOZERS: Bulldozer operator, 20,000 lbs. or less or 100 horse or less; COMPRESSORS: Compressor Operator (any power), over 1,250 cu. ft. total capacity; COMPACTORS: Compactor Operator, including vibratory; Wagner Pactor Operator or similar type (without blade); CONCRETE: Combination mixer and Compressor Operator, gunite work; Concrete Batch Plant Quality Control Operator; Beltcrete Operator; Pumpcrete Operator (any type); Pavement Grinder and/or Grooving Machine Operator (riding type); Cement Pump Operator, Fuller-Kenyon and similar; Concrete Pump Operator; Grouting Machine Operator; Concrete mixer operator, single drum, under (5) bag capacity; Cast in place pipe laying machine; maginnis Internal Full slab vibrator operator; Concrete finishing mahine operator, Clary, Johnson, Bidwell, Burgess Bridge deck or similar type; Curb Machine Operator, mechanical Berm, Curb and/or Curb and Gutter; Concrete Joint Machine Operator; Concrete Planer Operator; Tower Mobile Operator; Power Jumbo Operator setting slip forms in tunnels; Slip Form Pumps, power driven hydraulic lifting device for concrete forms; Concrete Paving Machine Operator; Concrete Finishing Machine Operator; Concrete Spreader Operator; CRANE: Helicopter Hoist Operator; Hoist Operator, single drum; Elevator Operator; A-frame Truck Operator, Double drum; Boom Truck Operator; HYDRAULIC CRANE OPERATOR: Hydraulic Boom Truck, Pittman; DRILLING: Churm Drill and Earth Boring Machine Operator; Vacuum Truck; Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Fireman; FORKLIFT: Fork Lift, over 10 ton and/or

robotic; HYDRAULIC HOES EXCAVATORS: Hydraulic Backhoe Operator, wheel type (Ford, John Deere, Case type); Hydraulic Backhoe Operator track type up to and including 20,000 lbs.; LOADERS: Loaders, rubber- tired type, less than 25,000 lbs; Elevating Grader Operator, Tractor Towed requiring Operator or Grader; Elevating loader operator, Athey and similar types; OILERS: Service oiler (Greaser); PIPELINE-SEWER WATER: Hydra hammer or simialr types; Pavement Breaker Operator; PUMPS: Pump Operator, more than 5 (any size); Pot Rammer Operator; RAILROAD EQUIPMENT: Locomotive Operator, under 40 tons; Ballast Regulator Operator; Ballast Tamper Multi-Purpose Operator; Track Liner Operator; Tie Spacer Operator; Shuttle Car Operator; Locomotive Operator, 40 tons and over; MATERIAL HAULRS: Cat wagon DJBs Volvo similar types; Conveyored material hauler; SURFACING (BASE) MATERIAL: Rock Spreaders, self-propelled; Pulva-mixer or similar types; Chiip Spreading machine operator; Lime spreading operator, construction job siter; SWEEPERS: Sweeper operator (Wayne type) self-propelled construction job site; TRACTOR-RUBBER TIRED: Tractor operator, rubber-tired, 50 hp flywheel and under; Trenching machine operator, maximum digging capacity 3 ft depth; TUNNEL: Dinkey

GROUP 6: ASPHALT: Plant Oiler; Plant Fireman; Pugmill Operator (any type); Truck mounted asphalt spreader, with screed; COMPRESSORS: Compressor Operator (any power), under 1,250 cu. ft. total capacity; CONCRETE: Plant Oiler, Assistant Conveyor Operator; Conveyor Operator; Mixer Box Operator (C.T.B., dry batch, etc.); Cement Hog Operator; Concrete Saw Operator; Concrete Curing Machine Operator (riding type); Wire Mat or Brooming Machine Operator; CRANE: Oiler; Fireman, all equipment; Truck Crane Oiler Driver; A-frame Truck Operator, single drum; Tugger or Coffin Type Hoist Operator; CRUSHER: Crusher Oiler; Crusher Feederman; CRUSHER: Crusher oiler; Crusher feederman; DRILLING: Drill Tender; Auger Oiler; FLOATING EQUIPMENT: Deckhand; Boatman; FORKLIFT: Self-propelled Scaffolding Operator, construction job site (exclduing working platform); Fork Lift or Lumber Stacker Operator, construction job site; Ross Carrier Operator, construction job site; Lull Hi-Lift Operator or Similar Type; GUARDRAIL EQUIPMENT: Oiler; Auger Oiler; Oiler, combination guardrail machines; Guardrail Punch Oiler; HEATING PLANT: Temporary Heating Plant Operator; LOADERS: Bobcat, skid steer (less than 1 cu yd.); Bucket Elevator Loader Operator, BarberGreene and similar types; OILERS: Oiler; Guardrail Punch Oiler; Truck Crane Oiler-Driver; Auger Oiler; Grade Oiler, required to check grade; Grade Checker; Rigger; PIPELINE-SEWER WATER: Tar Pot Fireman; Tar Pot Fireman (power agitated); PUMPS: Pump Operator (any power); Hydrostatic Pump Operator; RAILROAD EQUIPMENT: Brakeman; Oiler; Switchman; Motorman; Ballast Jack Tamper Operator; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER, ETC. OPERATOR: Oiler, Grade Oiler (required to check grade); Grade Checker; Fireman; SWEEPER: Broom operator, self propelled, construction job site; SURFACING (BASE) MATERIAL: Roller Operator, grading of base rock (not asphalt); Tamping Machine operartor, mechanical, self-propelled; Hydrographic Seeder Machine Operator; TRENCHING MACHINE: Oiler; Grade Oiler; TUNNEL: Conveyor operator; Air filtration equipment operator

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IRON0086-001 07/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Ironworker	$ 28.02	13.30

IRON0086-003 07/01/2004

CALLAM,GRAYS HARBOR, JEFFERSON, KING,KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Ironworker	$ 29.82	13.30

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* LABO0001-003 06/01/2005

	Rates	Fringes
Laborers:		
CHELAN AND KITTITAS COUNTIES ZONE 1:		
GROUP 1	$ 15.14	7.95
GROUP 2	$ 17.46	7.95
GROUP 3	$ 19.18	7.95
GROUP 4	$ 19.66	7.95
GROUP 5	$ 20.02	7.95
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary of Wahkiakum County west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES ZONE 1:		
GROUP 1	$ 18.56	7.95
GROUP 2	$ 20.88	7.95
GROUP 3	$ 25.56	7.95
GROUP 4	$ 26.04	7.95
GROUP 5	$ 26.40	7.95

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $ .70
ZONE 3 - $1.00

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the

respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Mortarman and Hodcarrier; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Powderman; Re-Timberman; Hazardous Waste Worker (Level A).

LABO0238-008 06/01/2004

CHELAN COUNTY

	Rates	Fringes
Hod Carrier.....	$ 21.05	6.80

LABO0335-003 06/01/2005

PACIFIC (South of a straight line made by extending the north Boundary line of Wahkiakum County west to the Pacific Ocean)

COUNTY

	Rates	Fringes
Laborers:		
ZONE 1:		
GROUP 1	$ 24.22	7.95
GROUP 2	$ 24.78	7.95
GROUP 3	$ 25.20	7.95
GROUP 4	$ 25.56	7.95
GROUP 5	$ 21.86	7.95
GROUP 6	$ 19.58	7.95
GROUP 7	$ 16.57	7.95

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Plant Laborers; Asphalt Spreaders; Batch Weighman; Broomers; Brush Burners and Cutters; Car and Truck Loaders; Carpenter Tender; Change-House Man or Dry Shack Man; Choker Setter; Clean-up Laborers; Curing-concrete; Demolition, Wrecking, and Moving Laborers; Dumpers, road oiling crew; Dumpmen (for grading crew); Elevator Feeders; Guard Rail, Median Rail, Reference Post, Guide Post, Right-of-way Marker; Fine Graders; Fire Watch; Form Strippers (not swinging stages); General Laborers; Hazardous Waste Worker; Leverman or Aggregate Spreader (Flaherty and similar types); Loading Spotters; Material Yard Man (including electrical); Pittsburgh Chipper Operator or similar types; Railroad Track Laborers; Ribbon Setters (including steel forms); Rip Rap Man (hand placed); Road Pump Tender; Sewer Laborer; Signalman; Skipman; Slopers; Spraymen; Stake Chaser; Stockpiler; Tie Back Shoring; Timber Faller and Bucker (hand labor); Toolroom Man (at job site); Tunnel Bullgang (above ground); Weight-Man-Crusher (aggregate when used)

GROUP 2: Applicator (including pot power tender for same), applying protective material by hand or nozzle on utility lines or storage tanks on project; Brush (power saw); Burners; Choker Splicer; Clary Power Spreader and similar types; Clean up-nozzleman-Green cutter (concrete, rock, etc.); Concrete Laborer; Concrete Power Buggyman; Crusher Feeder; Demolition and Wrecking Charred Materials; Gunite Nozzleman Tender; Gunite or Sand Blasting Pot Tender; Handlers or Mixers of all Materials of an irritating nature (including cement and lime); Pipe Doping & Wrapping; Tool Operators (includes but not limited to: Dry pack machine, Jackhammer, Chipping guns, Paving breakers); Post Hole Digger, air, gas or electric; Vibrating Screed; Tampers; Sand Blasting (wet); Stake-Setter; Tunnel-Muckers, Brakemen, Concrete Crew, Bull gang (Underground)

GROUP 3: Asbestos Removal (structural removal only); Bit Grinder; Drill Doctor; Drill Operators, air tracks cat drills, wagon drills, rubber-mounted drills, and other similar types; Concrete Saw Operator; Gunite Nozzleman; High scalers, strippers and drillers (covers work in swinging stages, chairs or belts, under extreme conditions unusual to normal drilling, blasting, barring-down, or sloping and stripping); Manhole Builder; Powdermen; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzlemen; Sand Blasting (dry); Sewer Timberman; Track Liners; Anchor Machines; Ballast Regulators; Multiple Tampers; Power Jacks; Tugger Operator; Tunnel-Chuck Tenders, Nippers and

Timbermen; Vibrator; Water Blaster

GROUP 4: Asphalt Raker; Concrete Saw Operator (walls); Concrete Nozzelman; Grade Checker; Pipelayer; Laser Beam (Tunnel) applicable when assigned to move, set up, align laser beam; Miner-Tunnel; Motorman-dinky Locomotive-Tunnel; Powderman-Tunnel; Shield Operator-Tunnel

GROUP 5: Traffic Flaggers

GROUP 6: Fence Builders

GROUP 7: Landscaping and Planting Laborers

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $0.65
ZONE 3 - 1.15
ZONE 4 - 1.70
ZONE 5 - 2.75

ZONE DEFINITIONS

BASE POINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall

ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall.

LABO0335-009 06/01/2004

PACIFIC(south of a straight line made by extending the north boundary of Wahkiakum County west to the Pacific Ocean)

	Rates	Fringes
Hod Carrier	$ 25.49	7.50

PAIN0005-001 03/14/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Painter	$ 19.00	6.60

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* PAIN0005-003 07/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Drywall Finisher	$ 28.06	12.23

PAIN0005-007 07/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Painters:		
BRUSH, PAPERHANGER, STEAM-CLEANING, STRIPING and SPRAY	$ 18.89	6.43
TV, RADIO, ELECTRICAL TRANSMISSION TOWERS	$ 20.64	6.43

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* PAIN0005-013 07/01/2005

CALLAM, GRAYS HARBOR, JEFFERSON, LEWIS, MASON, PACIFIC (NORTHERN PORTION), PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Soft Floor Layer	$ 22.20	9.55

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* PAIN0054-003 07/01/2005

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Drywall Finisher (TAPER)	$ 20.98	7.66

PAIN0054-008 10/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Glazier	$ 17.77	5.47

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* PAIN0054-011 04/01/2005

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Carpet, Linoleum & Soft Tile		
New construction, alteration and repair of one (1) story building with floor spaces not to exceed 12 feet in width	$ 15.50	5.22
All other work	$ 15.50	5.22

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* PAIN0055-008 07/01/2005

PACIFIC COUNTY

	Rates	Fringes
Drywall Finisher	$ 28.31	10.50

PAIN0055-009 05/16/2005

PACIFIC COUNTY

	Rates	Fringes
Painters:		
Brush & Roller	$ 18.03	6.63

High work - All work 60
ft. or higher.....$ 18.78 6.63
Spray and Sandblasting.....$ 18.63 6.63

PAIN0188-001 07/01/2005

CLALLAM, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH, THURSTON COUNTIES

	Rates	Fringes
Glazier (THURSTON COUNTY).....	$ 28.52	10.44
Glazier.....	$ 29.87	11.28

PAIN0188-002 07/01/2004

GRAYS HARBOR AND PACIFIC COUNTIES

	Rates	Fringes
Glazier.....	$ 12.65	8.87

PAIN1238-001 07/01/2005

KING, KITSAP AND SNOHOMISH COUNTIES

	Rates	Fringes
Soft Floor Layer.....	$ 23.58	9.56

PLAS0072-002 06/01/2005

CHELAN AND KITTITAS COUNTIES

Zone 1:

	Rates	Fringes
Cement Mason.....	$ 21.91	7.43

Zone Differential (Add to Zone 1 rates): Zone 2 - $2.00

BASE POINTS: Spokane, Pasco, Moses Lake, and Lewiston

Zone 1: 0 - 45 radius miles from the main post office

Zone 2: 45 radius miles from the main post office

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* PLAS0082-003 06/01/2005

PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean) COUNTY

	Rates	Fringes
Plasterer.....	$ 27.07	8.93

PLAS0528-002 06/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Cement Mason.....	$ 29.59	11.52

PLUM0032-001 01/01/2005

CHELAN AND KITTITAS (NORTHERN TIP) COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 25.88	12.78

PLUM0032-002 01/01/2005

CLALLAM, KING AND JEFFERSON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	$ 35.63	15.43

PLUM0265-001 01/01/2005

SNOHOMISH COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	$ 31.80	13.77

PLUM0598-002 06/01/2005

KITTITAS (ALL BUT NORTHERN TIP)

	Rates	Fringes
Plumbers and Pipefitters.....	$ 32.57	16.61

PLUM0631-001 01/01/2005

MASON (NE SECTION), AND KITSAP COUNTIES

	Rates	Fringes
Plumbers and Pipefitters		
All new construction, additions, and remodeling of commercial building projects such as: cocktail lounges and taverns, professional buildings, medical clinics, retail stores, hotels and motels, restaurants and fast food types, gasoline service stations, and car washes where the plumbing and mechanical cost of the project is less than $100,000.....	$ 21.45	5.18
All other work where the plumbing and mechanical cost of the project is $100,000 and over.....	$ 30.99	13.77

ROOF0054-001 06/01/2004

CLALLAM, JEFFERSON, KING, KITSAP, MASON AND SNOHOMISH COUNTIES

	Rates	Fringes
Roofer (including Built Up, Composition and Single Ply)....	$ 25.62	8.91

ROOF0153-001 01/01/2005

GRAYS HARBOR, LEWIS, PACIFIC, PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Roofer (including Built Up, Composition and Single Ply)....	$ 25.65	7.64

ROOF0189-001 07/01/2004

CHELAN COUNTY

	Rates	Fringes
Roofer (including Built Up, Composition and Single Ply)....	$ 20.36	6.95

ROOF0189-004 07/01/2004

KITTITAS COUNTY

	Rates	Fringes
Roofer (including Built Up, Composition and Single Ply)....	$ 21.30	6.20

SFWA0699-001 07/01/2004

KING, KITSAP, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Sprinkler Fitter.....	$ 34.34	13.90

SHEE0066-004 06/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Sheet Metal Worker.....	$ 32.78	15.34

SHEE0066-010 06/01/2005

KITTITAS COUNTY

	Rates	Fringes
Sheet Metal Worker.....	$ 25.89	12.72

TEAM0174-002 06/01/2005

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north

boundary line of Wahkiakum County west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE A:		
GROUP 1:.....	$ 26.94	11.58
GROUP 2:.....	$ 26.36	11.58
GROUP 3:.....	$ 23.96	11.58
GROUP 4:.....	$ 19.71	11.58
GROUP 5:.....	$ 26.70	11.58

ZONE B (25-45 miles from center of listed cities*): Add $.70 per hour to Zone A rates. ZONE C (over 45 miles from centr of listed cities*): Add $1.00 per hour to Zone A rates.

*Zone pay will be calculated from the city center of the following listed cities:

BELLINGHAM	CENTRALIA	RAYMOND	OLYMPIA
EVERETT	SHELTON	ANACORTES	BELLEVUE
SEATTLE	PORT ANGELES	MT. VERNON	KENT
TACOMA	PORT TOWNSEND	ABERDEEN	BREMERTON

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 -"A-frame or Hydralift" trucks and Boom trucks or similar equipment when "A" frame or "Hydralift" and Boom truck or similar equipment is used; Buggymobile; Bulk Cement Tanker; Dumpsters and similar equipment, Tournorockers, Tournowagon, Tournotrailer, Cat DW series, Terra Cobra, Le Tourneau, Westinghouse, Athye Wagon, Eucid Two and Four-Wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump Trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with 16 yards to 30 yards capacity: Over 30 yards $.15 per hour additional for each 10 yard increment; Explosive Truck (field mix) and similar equipment; Hyster Operators (handling bulk loose aggregates); Lowbed and Heavy Duty Trailer; Road Oil Distributor Driver; Spreader, Flaherty Transit mix used exclusively in heavy construction; Water Wagon and Tank Truck-3,000 gallons and over capacity

GROUP 2 - Bulllifts, or similar equipment used in loading or unloading trucks, transporting materials on job site; Dumpsters, and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat. D.W. Series, Terra Cobra, Le Tourneau, Westinghous, Athye wagon, Euclid two and four-wheeled power tractor with trailer and similar top-loaded equipment transporting material, Dump trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with less than 16 yards capacity; Flatbed: (Dual Rear Axle); Grease Truck, Fuel Truck, Greaser, Battery Service Man and/or Tire Service Man; Leverman and loader at bunkers and batch plants; Oil tank transport; Scissor, Slurry Truck; Sno-Go and similar equipment; Swampers; Straddler Carrier (Ross, Hyster) and similar equipment; Team Driver; Tractor (small rubber-tired (when used within Teamster jurisdiction); Vacuum truck; Water Wagon and Tank trucks-less than 3,000 gallons capacity; Winch truck; Wrecker, tow truck and similar equipment

GROUP 3 - Flatbed: single rear axle; Pickup sweeper, Pickup Truck (Adjust upward by $2.00 per hour for onsite work)

GROUP 4 - Escort or pilot driver

GROUP 5 - Mechanic

HAZMAT PROJECTS

Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:
LEVEL C: +$.25 per hour - This level uses an air purifying respirator or additional protective clothing.
LEVEL B: +$.50 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."
LEVEL A: +$.75 per hour - This level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

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* TEAM0760-004 06/01/2005

CHELAN AND KITTITAS COUNTIES

(ANYONE WORKING ON HAZMAT JOBS SEE FOOTNOTE A BELOW)

	Rates	Fringes
Truck drivers:		
ZONE 1		
GROUP 1	$ 19.43	9.90
GROUP 2	$ 22.07	9.90
GROUP 3	$ 22.18	9.90
GROUP 4	$ 22.51	9.90
GROUP 5	$ 22.62	9.90
GROUP 6	$ 22.78	9.90
GROUP 7	$ 23.32	9.90
GROUP 8	$ 23.64	9.90

Zone Differential (Add to Zone 1 rate: Zone 2 - $2.00)

BASE POINTS: Spokane, Moses Lake, Pasco, Lewiston

Zone 1: 0-45 radius miles from the main post office.
Zone 2: Outside 45 radius miles from the main post office

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Escort Driver or Pilot Car; Employee Haul; Power Boat Hauling Employees or Material

GROUP 2: Fish Truck; Flat Bed Truck; Fork Lift (3000 lbs. and under); Trailer Mounted Hydro Seeder and Mulcher; Leverperson (loading trucks at bunkers); Seeder & Mulcher; Stationary Fuel Operator; Tractor (small, rubber-tired, pulling trailer or similar equipment)

GROUP 3: Auto Crane (2000 lbs. capacity); Buggy Mobile & Similar; Bulk Cement Tanks & Spreader; Dumptor (6 yds. & under); Flat Bed Truck with Hydraulic System; Fork Lift (3001-16,000 lbs.); Fuel Truck Driver; Steamcleaner & Washer; Power Operated Sweeper; Rubber-tired Tunnel Jumbo; Scissors Truck; Slurry Truck Driver; Straddle Carrier

(Ross, Hyster, & similar); Tireperson; Transit Mixers & Truck Hauling Concrete (3 yd. to & including 6 yds.); Trucks, side, end, bottom and articulated end dump (3 yards to and including 6 yds.); Warehouseperson (to include shipping & receiving); Wrecker & Tow Truck

GROUP 4: A-Frame; Burner, Cutter, & Welder; Service Greaser; Trucks, side, end, bottom and articulated end dump (over 6 yds. to & including 12 yds.); Truck Mounted Hydro Seeder; Warehouseperson; Water Tank truck (0-8000 gallons)

GROUP 5: Dumpster (over 6 yds.); Lowboy (50 tons & under); Self- Loading Roll Off; Semi-Truck & Trailer; Tractor with Steer Trailer; Transit Mixers and Trucks Hauling Concrete (over 6 yds. to and including 10 yds.); Trucks, side, end, bottom and articulated end dump (over 12 yds. to & including 20 yds.); Truck-Mounted Crane (with load bearing surface either mounted or pulled)(up to 14 ton); Vacuum Truck (super sucker, guzzler, etc.)

GROUP 6: Flaherty Spreader Box Driver; Flowboys; Fork Lift (over 16,000 lbs.); Dumps (Semi-end); Lowboy (over 50 tons); Mechanic (Field); Transfer Truck and Trailer; Transit Mixers & Trucks Hauling Concrete (over 10 yds. to & including 20 yds.); Trucks, side, end, bottom and end dump (over 20 yds. to & including 40 yds.); Truck and Pup; Tournarocker, DWs & similar with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater; Water Tank Truck (8,001- 14,000 gallons)

GROUP 7: Oil Distributor Driver; Stringer Truck (cable operated trailer); Transit Mixers & Hauling Concrete (over 20 yds.); Truck, side, end, bottom and articulated end dump (over 40 yds. to & including 100 yds.); Truck Mounted Crane (with load bearing surface either mounted or pulled (16 through 25 tons)

GROUP 8: Prime Movers and Stinger Truck; Trucks, side, end, bottom and articulated end dump (over 100 yds.); Helicopter Pilot Hauling Employees or Materials

FOOTNOTE A - Anyone working on a HAZMAT job, where HAZMAT cerfification is required, shall be compensated as a premium, in addition to the classification working in as follows:

LEVEL C-D: - $.50 PER HOUR - This level may use an air purifying respirator or additional protective clothing.

LEVEL A-B: - $1.00 PER HOUR - Uses supplied air in conjunction with a chemical splash suit or fully encapsulated suit with a self-contained breathing apparatus.

Employees shall be paid Hazmat pay in increments of four(4) and eight(8) hours.

NOTE:
Trucks pulling equipment trailers shall receive$.25/hour over applicable truck rate.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour DivisioN
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

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10430 EXTERIOR SIGNAGE
10440 INTERIOR SIGNAGE
10520 FIRE EXTINGUISHER CABINETS AND ACCESSORIES
10650 OPERABLE PARTITIONS
10655 ACCORDION FOLDING PARTITIONS
10800 TOILET ACCESSORIES
10990 MISCELLANEOUS BUILDING SPECIALTIES

DIVISION 11 - EQUIPMENT

11040 PREFABRICATED BAPTISTERY
11050 PREFABRICATED STEEPLE
11452 RESIDENTIAL APPLIANCES

DIVISION 12 - FURNISHINGS

12490 WINDOW TREATMENT
12495 CURTAIN, TRACK AND MACHINE
12670 PEWS

DIVISION 13 - SPECIAL CONSTRUCTION

13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT
13100 LIGHTNING PROTECTION SYSTEM
13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)
13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE
13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
13965 WET CHEMICAL FIRE EXTINGUISHING SYSTEM

DIVISION 15 - MECHANICAL

15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT
15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS
15216 WELDING PRESSURE PIPING
15400 PLUMBING, GENERAL PURPOSE
15556 FORCED HOT WATER HEATING SYSTEMS USING WATER TO WATER HEAT EXCHANGERS
15741 WATER SOURCE HEAT PUMP SYSTEMS
15750 RADIANT FLOOR HEATING AND COOLING SYSTEM
15760 UNITARY HEATING UNITS
15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
15910 DIRECT DIGITAL CONTROL (DDC) SYSTEMS
15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
15995 COMMISSIONING OF BUILDING SYSTEMS

DIVISION 16 - ELECTRICAL

16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
16415 ELECTRICAL WORK, INTERIOR
16420 WORSHIP CENTER THEATRICAL LIGHTING EQUIPMENT
16475 COORDINATED POWER SYSTEM PROTECTION
16528 EXTERIOR LIGHTING
16710 PREMISES DISTRIBUTION SYSTEM
16711 TELEPHONE SYSTEM, OUTSIDE PLANT
16751 CLOSED CIRCUIT TELEVISION SYSTEMS
16770 RADIO AND PUBLIC ADDRESS SYSTEMS
16772 MASS NOTIFICATION SYSTEM
16777 AUDIO SYSTEMS
16792 WIRE LINE DATA TRANSMISSION SYSTEM
16844 ELECTRONIC CARILLON SYSTEM

-- End of Project Table of Contents --

SECTION 01001

SUPPLEMENTARY REQUIREMENTS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

Initial Project Schedule; G

CONSTRUCTION PROGRESS CHARTS AND STATUS REPORTS; G

Contractor's progress schedule; G

Monthly Project Status Report; G

training plan; G

MECHANICAL AND ELECTRICAL LAYOUT DRAWINGS

SD-07 Certificates

qualifications of the trainer; G

SD-10 Operations and Maintenance Data

AUDIO-VIDEO RECORDINGS; G

1.2 CONSTRUCTION SCHEDULING

The Contractor shall prepare and submit an Initial Project Schedule. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors working on the project shall also contribute in developing. The Initial Project Schedule shall be used to measure the progress of the work and aid in evaluating time extensions.

The instructions for preparation and submittal of the Contractor-prepared Network Analysis System are found in SECTION 01320, PROJECT SCHEDULE.

1.3 CORRESPONDENCE

1.3.1 Labeling Correspondences

All correspondence shall be addressed to the Administrative Contracting Officer, shall be serially numbered commencing with Number H-0001 for home office letters and S-0001 for site office letters, with no numbers missing or duplicated and shall be furnished with an original and one copy. Enclosures attached or transmitted with the correspondence shall also be

furnished with an original and one copy. Each serial letter shall make reference to the contract name, contract number and shall have only one subject.

All correspondence from the Contracting Officer will be also serially numbered with no numbers missing or duplicated. Letters to the Contractor will be forwarded in duplicate.

In the event there is more than one project within a contract, correspondence shall contain separate and distinct submittals to identify each project by name.

1.3.2 Submission of Contractor Payment Requests

For submission of Contractor payment requests, See Section 01025, PAYMENT.

1.4 ADVANCED NOTICE OF CONTRACTOR PERFORMED ACCEPTANCE TESTING

The Contractor shall notify the Contracting Officer a minimum of 20 days prior to performing any acceptance or "buy off" testing of the following systems, (1) EMCS, (2) Fire Detection/Protection, (3) Intrusion Detection System, (4) Uninterruptible Power Supply, (5) HVAC, (6) AFFF, and (7) Hydrant Refuel. Advance notification is not required for testing performed as part of fabrication or installation.

1.5 CONTRACTOR'S FILES

Contractor shall maintain "Approved (Action Code "A") and "Approved Except as Noted (Action Code "B") shop drawing files in fabrication shops and at project sites for government use.

1.6 AUDIO-VIDEO RECORDINGS

1.6.1 General

The Contractor shall provide all equipment, materials, and trained personnel to visually and audibly record (video record) all on site operations and maintenance (O&M) training sessions for this contract. The video technician shall be a video professional with a minimum of 2 years experience. The Contractor shall submit the resume of the technician and name and address of affiliated video production company, performing services, if applicable. Also the Contractor shall submit for approval an agenda or an outline breakdown of the proposed presentation. Videos shall be produced in the DVD format. Audio shall be adjusted, filtered or otherwise controlled to ensure that the trainer can be understood at all times. Each system or piece of equipment shall be covered in a single tape or set of tapes which shall be correlated with the O&M manuals provided. DVDs and their individual storage cases shall be identified with a typewritten label showing the project, equipment or system, and contract number; this same information shall be provided as an introduction on each DVD. When two or more DVDs are provided, they shall be submitted as a set in an appropriate storage container.

1.6.2 Submittals

Prior to conducting the training sessions the following shall be submitted for approval:

1) A training plan consisting of the agenda or an outline breakdown of the proposed presentation and

2) The qualifications of the trainer and the video recording technician

Two copies of the video taped material shall be submitted to the Contracting Officer within 10 days after completion of video taping the training sessions.

1.7 MECHANICAL AND ELECTRICAL LAYOUT DRAWINGS

The Contractor shall submit, for Contracting Officer's approval, scaled layout drawings, including appropriate elevations and sections, as required, showing the room arrangement the Contractor proposes for all pieces of mechanical and electrical equipment and appurtenances thereto, such as but not limited to: air conditioning equipment, boilers, compressors, hot water tanks, pumps, electrical control panels, ducts and piping that are to be located in the room. Mechanical and electrical layouts shall be coordinated to eliminate any conflicts of installed equipment. No payments will be made to the Contractor for furnishing or installing equipment until the layout drawings have been approved by the Contracting Officer. Mechanical and electrical equipment layout drawings shall be identified and submitted as specified herein. Equipment rooms shown on the drawings are of adequate size to accommodate equipment of required capacities as available from several manufacturers with sufficient space left for access, servicing, and removal. The use of equipment items with dimensions such as "to crowd the space" will not be permitted.

1.8 COLOR BOARDS

Three sets of color boards shall be submitted within 60 calendar days after receipt of Notice to Proceed. The board shall include samples of colors and finishes of every finish such as on walls, floors, and ceilings. This would include, but not be limited to, paint, floor and wall tile, acoustical panels, carpet, wall base, plastic laminate, etc. Where special finishes such as architectural concrete or prefinished metal panels are required, samples of not less than 305 mm (12 inches) square shall be submitted with the board. Boards shall include, where applicable, color samples of integrally colored block, brick, and prefinished metal roofing and siding. The board shall be 610 mm by 610 mm (24 inches by 24 inches). If more space is needed, more than one board per set may be submitted. This is not meant to replace the samples called for in other portions of the specifications. The Contractor shall certify that he has reviewed the color boards in detail and that they are in strict accordance with the contract drawings and specifications, except as may be otherwise explicitly stated.

1.9 SAMPLE ROOM

After all finish materials have been submitted and approved, but prior to

the installation of any of them, the Contractor shall construct and completely finish one sample room that is/will be representative of all other rooms. Finishes shall include, but not necessarily be limited to, paint, wall covering of any type, floor finish of any type including base, ceiling finish of any type, and all electrical and mechanical finish trim. No payment will be made for any installation of finish materials until this room has been constructed and approved by a representative of the Contracting Officer. Once approved, this room shall serve as the "model" for finish and workmanship of all other rooms in the facility.

1.10 COMMERCIAL VEHICLE ACCESS TO FORT LEWIS - REGISTERED AND PREVIOUSLY ID'D (RAPID) GATE PROGRAM

Procedures for commercial vehicle access to Fort Lewis are subject to change without prior notice. Current access information may be obtained by calling (253) 967-1733. As of 1 May 2004, the following requirements apply:

a) Unless the contractor voluntarily participates in the RAPID Gate Program, commercial vehicle access to Fort Lewis will be allowed only at the Logistics Center Gate (Exit 123 from I-5) and through the D Street Commercial Vehicle Inspection Point on North Fort. Both gates are open Monday through Friday, excluding federal holidays. These gates will be open for inbound commercial vehicle access and inspection between 0530 hours and 2100 hours. These gates are closed on weekends (Saturdays and Sundays) and federal holidays. On Saturdays, Sundays and federal holidays, commercial vehicles must use the Main Gate (Exit 120 from I-5). Main Gate is open 24 hours per day everyday. A visitor pass must be obtained. All commercial vehicles will be searched. The Contractor should anticipate delays in getting commercial vehicles on post. The Contractor must also allow additional time for commercial vehicles to reach their destination by driving through Fort Lewis.

If the commercial vehicle is carrying a load of cement concrete or hot asphalt concrete for delivery, the driver shall notify the gate guard as soon as possible and request that the vehicle be given priority for being searched; however, the Government does not guarantee that the vehicle will be given priority.

On weekends large vehicles (needing greater than 12'-5" clearance) will require a time stamped "searched" label to gain access to North Fort Lewis. "Searched" labels will be issued at the Main Gate, as appropriate. Drivers needing access to North Fort Lewis must inform the gate guard that their vehicle is over 12'-5" in height and that they will require access to North Fort Lewis. The driver will receive a briefing on proper procedures and a "searched" label. The Contractor shall ensure that its drivers, including drivers of subcontractors at any tier, comply with the procedures as explained to them for access to North Fort Lewis.

b) If the contractor participates in the RAPID Gate Program, contractor vehicles may enter the installation through any RAPID gate lane except at Force Protection Level Charlie or Delta. During Force Protection Level Charlie or Delta, all contractor vehicles must enter through the Logistics Center gate or, if the Logistics Center Gate is

closed, through the Main Gate. All passengers in the contractor vehicle must have a RAPID identification card; otherwise, the contractor vehicle must enter through the Logistics Center Gate or the Main Gate, as appropriate and obtain visitor passes. Once the RAPID Gate Program is fully implemented, RAPID gate lanes will be at the Main (Liberty) Gate, the East Gate, the DuPont Gate, the D Street Gate, the Logistics Center Gate, the Madigan Army Medical Center Gate, and the North Fort Gate. The contractor shall use only those lanes specifically marked as RAPID lanes.

c) **NOTE: The RAPID Gate Program is a test program which is scheduled to end on 30 April 2005 but may be terminated by the Government or by Eid Passports, Inc., at any time.** If the program is terminated, the contractor will be allowed access only through the Logistics Center Gate or the D Street Gate or, when they are closed, the Main Gate unless the contractor is otherwise notified by the Contracting Officer.

1.11 IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS:

1.11.1 Compliance with Regulations

The Contractor shall be responsible for compliance with all regulations and orders of the Commanding Officer of the Military Installation, respecting identification of employees, movements on installation, parking, truck entry, and all other military regulations which may affect the work.

1.11.2 Specific Requirement for Vehicle Registration

The Commanding Officer of Fort Lewis, Washington, has initiated the following specific requirement regarding vehicle registration for this contract:

a) Contractors performing work on Fort Lewis shall, after award, register all vehicles to be used on the installation with the Vehicle Registration Section of the Law Enforcement Command. Contractor employees entering the installation in privately owned vehicles (POVs) shall also register their vehicles. A copy of contract award, proof of liability insurance, current driver's license and state vehicle registration shall be required to register Contractor, subcontractor, and employee vehicles.

b) Upon completion of the contract, it shall be the prime Contractor's responsibility to collect all vehicle decals issued under the contract including those issued to employees and subcontractors. Decals are to be carefully removed from the vehicle, placed in an envelope and attached to the original documentation (i.e., post vehicle registration document) received with the decal. Decals, with documentation, must be returned to Vehicle Registration, Building 2140. Proof of decal clearance for all vehicles registered under this contract will be issued to the prime Contractor and shall be returned to the Contracting Officer prior to final payment.

c) In the event of contract extension, it shall be the prime Contractor's responsibility to report time extension to Vehicle

Registration, with evidence of same. For further information, contact Vehicle Registration at Waller Hall, Building 2140 (Telephone: (253) 967-5065), Fort Lewis, Washington 98433-9500.

1.11.3 Employee Access and Identification

a) Each employee who requires access to Fort Lewis to perform work under any contract, at any tier, must obtain either a RAPID identification badge or a visitor's pass to obtain access to Fort Lewis. A RAPID identification badge will only be issued to an employee, at any tier, if the employee requires access to Fort Lewis more than twice per week. Contractor employees, at any tier, who require access to Fort Lewis twice per week or less often or who do not participate in the RAPID Gate Program shall obtain a visitor's pass at the Main (Liberty) Gate, the Logistics Center Gate or the D Street Gate. The visitor's pass will be issued for a maximum of 30 days at a time. A RAPID identification badge will only be issued to contractor employees if the contractor participates in the RAPID Gate Program. The RAPID Gate Program is a voluntary program. The production of RAPID badges has been contracted out and the cost of the identification card shall be borne by the contractor. Current established costs are: $99.00 for company start-up and $99.00 per individual.

b) If an employee no longer needs an identification badge for any reason (e.g., quits his/her job or no longer performs work under the contract), the contractor shall return the identification badge to Eid within two (2) calendar days of such change. If the identification badge cannot be returned within the required time frame for any reason, the contractor shall immediately notify both Eid and the Contracting Officer verbally, followed up in writing the next work day. An employee's inability to obtain entrance to a Government installation because he/she does not have the required identification badge or visitor's pass shall not excuse timely performance of the requirements of this contract. Eid or the Government may change the location at which identification badges are issued or returned, with or without advance notice to the contractor. Any such changes shall not be a basis for adjusting the contract price under any clause of this contract.

c) RAPID identification badges shall not be reproduced or copied by the contractor, its subcontractors, or their employees. If an employee's identification badge is lost, stolen, or reproduced, the contractor shall verbally report the loss, theft, or reproduction to both Eid and the Contracting Officer on the day such loss, theft, or reproduction is discovered, followed by a written report of the circumstances to both Eid and the Contracting Officer within one (1) calendar day after the loss, theft, or reproduction is discovered.

d) Each contractor employee shall wear the RAPID identification badge while performing work under the contract. The identification badge shall be worn on the upper front of the outer garment unless precluded by OSHA regulation(s). The identification badge shall not be used for access to any Government installation except for performance of work under the contract for which it was issued.

e) The contractor shall, upon expiration or termination of the contract,

collect all identification badges and turn them in to Eid. The final invoice will not be considered proper for purposes of the Prompt Payment Act (FAR 52.232-25 or FAR 52.212-4(i)) until all identification badges have been accounted for."

1.11.3.1 Issuance of RAPID Identification Badge

The contractor shall provide information as required by Eid Passport, Inc. (Eid), to enable Eid to conduct a criminal history background check (CHBC) on contractor employees who are to have access to Fort Lewis. The contractor is responsible for paying Eid the fee per employee for conducting the CHBC and issuing the RAPID identification card. If the CHBC is not adverse, a RAPID identification badge will be issued by Eid to the contractor employee. If the CHBC is adverse, Eid is prohibited from issuing a RAPID identification badge to the contractor employee. If a RAPID identification badge is denied for any reason, the contractor employee may only enter the installation by obtaining a visitor’s pass; however, if the contractor employee does not meet the criteria for being issued a RAPID identification badge, the Government may, in its sole discretion, decide not to issue a visitor’s pass to the contractor employee.

1.11.4 Compliance with Rules, Regulations, and Statutes

All Contractor employees shall observe and comply with all applicable local, State, and Federal rules, regulations, and statutes including those concerning fire, safety, sanitation, security, vehicle safety, and hazardous material handling.

1.11.5 Work Hours

Work hours in the construction area shall be restricted to 7:30 a.m. to 4:30 p.m. daily, Monday through Friday, excluding Federal holidays. Work hours other than as specified above shall be coordinated with and approved by the Contracting Officer.

1.11.6 Firearms

Contractor personnel while performing work under this contract shall carry no firearms.

1.11.7 Entrance Denial by Military Police

Contractor employees may be denied entry to the Installation by Military Police if it is determined that such entry may be contrary to good order, discipline, or the security of the Installation.

1.12 PERMITS OBTAINED BY GOVERNMENT AND CONTRACTOR RESPONSIBILITIES

The Government has obtained the following permits/licenses related to the construction of this project:

It will be the responsibility of the Contractor to obtain all other permits/licenses required for this project. See the Contract Clause paragraph entitled PERMITS AND RESPONSIBILITIES.

1.13 PRESERVATION OF HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES (1985 JAN OCE)::

If, during construction activities, the Contractor observes items that might have historical or archeological value, such observations shall be reported immediately to the Contracting Officer so that the appropriate authorities may be notified and a determination can be made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in the destruction of these resources and shall prevent his employees from trespassing on, removing, or otherwise damaging such resources.

1.14 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (ER 415-1-15 31 OCT 89)

This Paragraph specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE entitled "Default (Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

FT. LEWIS MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
9	8	8	4	2	3	1	2	4	7	10	10

1.14.1 Recording daily Adverse Weather

Upon acknowledgment of the notice to proceed (NTP) and continuing throughout the contract, the Contractor shall record on the daily QCQ report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delays must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 1.17, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled " Default (Fixed Price Construction)".

1.15 COMPLIANCE WITH DAVIS-BACON ACT

1.15.1 Contractor POC

Within 14 days after award of the contract, the Contractor shall designate a point of contact (POC) within their organization who will be responsible for the Davis-Bacon Act Labor Program for the Contractor and all subcontractors under this contract as required by the Contract Clauses and FAR 52.222.

1.15.2 Responsibilities

The designated Contractor POC shall be responsible for Davis-Bacon Act Labor Program activities including, but not limited to:

Documentation and record keeping
Submittal and accuracy of certified payrolls
Submittal of required labor forms including requests for additional classifications and rates, Statements and Acknowledgement, etc.
Posting of the wage determination, approved additional classifications and rates, labor and EEO posters
Coordination with the Contracting Officer's Labor Program POC

Prior to submittal to the Government, payrolls shall be reviewed for compliance to all applicable labor standards, to include, but not be limited to the following items: correct wage rates, correct overtime classification and pay, misclassification of workers for work actually performed, apprentice to journeyman ratios, and registration of apprentice. Corrective actions shall be taken as necessary to ensure Contractor

compliance with applicable contract and FAR clauses.

1.15.3 Certification

The Contractor POC shall provide a signed certification stating the following: "I certify that the submitted items being forwarded have been reviewed in detail and are correct and in strict conformance with the Labor Standards of the contract except as otherwise stated."

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

SECTION 01005

SITE SPECIFIC SUPPLEMENTARY REQUIREMENTS

PART 1 GENERAL

1.1 COORDINATION AND ACCESS TO SITE

1.1.1 COORDINATION AND ACCESS TO SITE

1.1.1.1 Coordination with using agencies shall be made through the Contracting Officer to assist the Contractor in completing the work with a minimum of interference and inconvenience.

1.1.1.2 Vehicle Access:

1.1.1.2.1 All Contractor-owned and privately-owned vehicles require an access pass/vehicle decal. This pass is obtained from the Fort Lewis Vehicle Registrar, Building 2140 (Waller Hall) by showing proof of insurance; the vehicle registration; Washington State driver's license; and a letter with original signature of prime Contractor or his superintendent stating the contract name and number, the contract period for which the pass is required, and the employee's name. See Paragraph IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS in SECTION 01001 for specific requirements.

1.1.1.2.2 Commercial vehicle access to Fort Lewis will be allowed at the Logistic Center Gate (Exit 123 from I-5) and the Dupont Gate (Exit 119 from I-5). The Logistics Center Gate (primary access point for commercial traffic) is open for inbound commercial vehicle access and inspection from 0530 hours to 2000 hours, Monday through Friday. The Dupont Gate (secondary access point for commercial access) is open for inbound commercial vehicle access and inspection from 0530 hours to 2000 hours 7 days per week. All commercial vehicles will be searched. Drivers should anticipate delays.

1.1.1.2.3 If the commercial vehicle is a cement concrete truck carrying a load for delivery, carrying a load of hot asphalt concrete for delivery, or a garbage or refuse collection truck, the driver shall notify the gate guard as soon as possible and request that the vehicle be given priority for being searched; however, the Government does not guarantee that the vehicle will be given priority.

1.1.1.2.4 Large vehicles (needing greater than 12'-5" clearance) will require a time-stamped "searched" label to gain access to North Fort Lewis. "Searched" labels will be issued at the Logistic Center Gate. Drivers of such vehicles needing access to North Fort Lewis must declare that their vehicle is over 12'-5" in height and that they will require access to North Fort Lewis to receive a briefing on proper procedures and a "searched" label.

1.1.1.2.5 Commercial vehicles less than 12'-5" in height shall access North Fort Lewis only via the Pendleton Avenue Overpass once they are cleared through the Logistic Center Gate.

1.1.1.2.6 Procedures for commercial vehicle access to Fort Lewis are subject to change without prior notice.

1.1.1.3 When keys are required for access to facilities on this contract, they shall be obtained through the Contracting Officer.

1.1.1.3.1 The Contractor shall be responsible for Government-owned keys issued for access to facilities or areas pertinent to this contract.

1.1.1.3.2 Upon completion of the work in an area, or upon request of the Contracting Officer, the key or keys relevant to the completed areas shall be returned.

1.1.1.3.3 Should the Contractor lose a key:

a. the Contracting Officer shall be notified, in writing, within three (3) working days after the loss is discovered and

b. should the key not be found before final acceptance, the final contract payment shall be reduced by $100 for each key not returned.

1.1.1.4 Work hours in the construction area will be restricted to 7:30 a.m. to 4 p.m. daily, Monday through Friday, excluding Federal holidays. Work hours other than as specified above shall be coordinated with and approved by the Contracting Officer.

1.1.1.5 Contractor's workmen shall wear a Government-issued identification badge, as specified in SECTION 01001. All employees of the prime Contractor and subcontractors must be named on the Entry List issued by the Fort Lewis Director of Contracting. Coordinate the Entry List through the Contracting officer prior to commencing construction.

1.1.2 UTILITY OUTAGES

Contractor shall coordinate utility outages with the Contracting Officer at least 7 days in advance. Outages shall be kept to a minimum and any one outage shall not last more than 2 hours.

1.1.3 PROTECTION OF GOVERNMENT PROPERTY

In addition to requirements of the CONTRACT CLAUSES, Contractor shall protect all Government property within the buildings in which he is working, except for such property as is required to be demolished. Property which is to be demolished shall be protected until its scheduled demolition time. Protection shall include, but not be limited to, protection from construction generated dust, debris, water, and vibration.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

SECTION 01025

PAYMENT

PART 1 GENERAL

1.1 GENERAL

The contract price for each item shall constitute full compensation for furnishing all plant, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the items in accordance with these specifications and the applicable drawings, including surveying performed by the Contractor. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. No separate payment will be made for the work, services, or operations required by the Contractor, as specified in DIVISION 1, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

1.2 PAYMENT

1.2.1 ITEM 0001 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0001, All Work for FY05 Chapel Complex, Except for Items 0002through 0011, payment of which shall constitute full compensation for Item No. 0001, complete.

1.2.2 ITEM 0002 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0002, All Work for As-Built Drawings as specified in Section 01702 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0002, complete. No partial or total payment will be made for this item until the as-built drawings, both marked up blue prints and electronic files are fully approved by the Government (A or B action) and all copies of approved drawings and electronic media received by the Government.

1.2.3 ITEM 0003 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0003, All Work for O&M Manuals as as specified in Section 01701 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0003, complete. No partial or total payment will be made for this item until all O&M manuals are fully approved by the Government (A or B action) and all copies of final manuals are received by the Government in their final binders.

1.2.4 ITEM 0004 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0004, All Work for Form 1354 Checklist and Equipment in Place List as specified in Sections 01704 and 01705 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0004, complete. No partial or total payment will be made for this item until both the 1354 Checklist and Equipment in Place List are fully approved by the Government (A or B action) and all copies of approved lists received by the Government.

1.2.5 ITEM 0005 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0005, All Work for Free Standing Storage Building, payment of which shall constitute full compensation for Item No. 0005, complete.

1.2.6 ITEM 0006 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0006, All Work for Landscaping of Parking Islands, Except for Irrigation System, payment of which shall constitute full compensation for Item No. 0006, complete.

1.2.7 ITEM 0007 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0007, All Work for Planting Areas Adjacent to South Drive, Continuing to 41st Division Drive, Except for Irrigation System, payment of which shall constitute full compensation for Item No. 0007, complete.

1.2.8 ITEM 0008 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0008, All Work to Landscape Buffer Areas South of the Chapel, Except for Irrigation System, payment of which shall constitute full compensation for Item No. 0008, complete.

1.2.9 ITEM 0009 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0009, All Work for Lawn Areas, Except for Irrigation System, payment of which shall constitute full compensation for Item No. 0009, complete.

1.2.10 ITEM 0010 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0010, All Work for Cobble Mulch Area Between Sidewalk and Chapel, Except for Irrigation System, payment of which shall constitute full compensation for Item No. 0010, complete.

1.2.11 ITEM 0011 (OPTIIONAL ITEM)

Payment will be made at the contract lump sum price for Item No. 0011, All Work for Irrigation System, payment of which shall constitute full compensation for Item No. 0011, complete.

1.3 PROGRESS PAYMENT INVOICE

Requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

1.3.1 When submitting payment requests, the Contractor shall complete Blocks 1 through 12 of the "PROGRESS PAYMENT INVOICE" Form as directed by the Contracting Officer. (A sample form is attached at the end of this Technical Specification Section.) The completed form shall then become the cover document to which all other support data shall be attached.

1.3.2 One additional copy of the entire request for payment, to include the "PROGRESS PAYMENT INVOICE" cover document, shall be forwarded to a separate address as designated by the Contracting Officer.

1.3.3 The Contractor shall submit with each pay request, a list of subcontractors that have worked during that pay period. The listing shall be broken down into weeks, identifying each subcontractor that has worked during a particular week, and indicate the total number of employees that have worked on site for each subcontractor for each week. The prime Contractor shall also indicate the total number of employees for its on site staff for each week.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

PROGRESS PAYMENT INVOICE

See Federal Acquisition Regulations (FAR) 32.900, 52.232-5, & 52.232-27

1. PROJECT AND LOCATION	2. DATE
3. CONTRACTOR NAME AND ADDRESS (Must be the same as in the Contract)	4. CONTRACT NO. _____ 5. INVOICE NO.
6. DESCRIPTION OF WORK	7. PERIOD OF PERFORMANCE From: To:
8. DISCOUNT TERMS	
9. OFFICIAL TO WHOM PAYMENT IS TO BE FORWARDED Name: Title: Phone: ( ) -	10. OFFICIAL TO BE NOTIFIED OF DEFECTIVE INVOICE Name: Title: Phone ( ) -

11. CERTIFICATION: I hereby certify, to the best of my knowledge and belief, that

(1) The amounts requested are only for the performance in accordance with the specifications, terms, and conditions of this contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; and

(3) This request for progress payment does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

_____ _____ _____

(Signature) **(Title)** **(Date)**

12. OTHER INFORMATION OR DOCUMENTATION required by Contract. Provide two (2) copies of each (check and attach if applicable): _____ Updated Progress Chart/Schedule _____ Progress Narrative _____ Certified Payrolls (submitted weekly) _____ Safety Exposure Report _____ Updated Submittal \register _____ Progress Photos _____ Subcontractor/Employee Listings	(FOR GOVERNMENT USE ONLY) Retainage: _____% Amt.: $_____ Withholdings: $ _____ Reason: _____ _____ Following items are current: As-Builts _____ Yes _____ No O & M Manuals _____ Yes _____ No 1354 Data _____ Yes _____ No Submittal Register _____Yes _____No

END OF SECTION

SECTION 01035

MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 PROPOSED PROJECT MODIFICATIONS:

Price proposals for proposed modifications shall be submitted in accordance with the requirements of the Contract Clause MODIFICATION PROPOSALS - PRICE BREAKDOWNS. If change order work impacts or delays other unchanged contract work, the costs of such impacts or delays shall be included in the proposals and separately identified. Additional instructions for submitting price proposals can be found in NPSP-415-1-1, INSTRUCTION AND INFORMATION FOR CONTRACTORS, a copy of which will be furnished to the Contractor at the Preconstruction Conference. For information applicable to equipment rates used in contract modifications, refer to 00800 - SPECIAL CLAUSES, clause "EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE".

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

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SECTION 01312

QUALITY CONTROL SYSTEM (QCS)

PART 1 GENERAL

1.1 QUALITY CONTROL SYSTEM (QCS)

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to

download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on (3-1/2 inch) high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

- IBM-compatible PC with 200 MHz Pentium or higher processor
- 32+ MB RAM
- 4 GB hard drive disk space for sole use by the QCS system
- 3 1/2 inch high-density floppy drive
- Compact disk (CD) Reader
- Color monitor
- Laser printer compatible with HP LaserJet III or better, with minimum 4 MB installed memory.
- Connection to the Internet, minimum 28 BPS

Software

- MS Windows 95 or newer version operating system (MS Windows NT 4.0 or newer is recommended)
- Word Processing software compatible with MS Word 97 or newer
- Internet browser
- The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.
- Electronic mail (E-mail) compatible with MS Outlook

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a

CD-ROM containing these instructions.

1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to

the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work

progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320, PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of

running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

PART 2 NOT USED.

PART 3 NOT USED.

-- End of Section --

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SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having this designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Preliminary project schedule, two (2) copies; G

initial project schedule, two (2) copies; G
Activity No. Sort
Predecessor/successor listing
Cost Schedule
Floppy Disk with schedule data in Standard Data Exchange Format (SDEF).
Activity Code Dictionary.

Periodic schedules updates, monthly updates two (2) copies
Floppy Disks with schedule data in Standard Data Exchange Format (SDEF).
Narrative
Activity No. Sort
Cost Schedule
Cash Flow Report (S-Curve)

SD-08 Statements

Qualifications; G

Documentation showing qualifications of personnel preparing schedule reports.

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project should also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification including the SDEF (Standard Data Exchange Format). Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

With the exception of the initial and preliminary schedule submission, the Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule.

3.3.2.1 Activity Durations

Contractor submissions shall be required to follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods. A rule of thumb, that the Contractor should use, is that less than 2 percent of all non-procurement activities' Original Durations shall be greater than 20 days.

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.

3.3.2.3 Government Activities

Government and other agencies activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.

3.3.2.4 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, (at the lowest tier), Contractor work force, or Government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.5 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.6 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.7 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more

than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.8 Phase of Work

All activities shall be identified in project schedule by phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.9 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.10 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.2.11 Critical Activities

The following activities shall be listed as separate line activities on a Contractor's project schedule:

- Submission and approval of mechanical/electric layout drawings
- Submission and approval of O&M manuals
- Submission and approval of as-built drawings
- Submission and approval of 1354 data and installed equipment lists
- Submission and approval of testing and air balance (TAB) firm
- Submission of TAB specialist design review report
- Submission and approval of fire protection specialist
- Submission and approval of testing and balancing and HVAC commissioning plans and data
    - Air and water balance dates
    - HVAC commissioning dates
    - Controls testing plan
    - Controls testing
    - Performance Verification testing
    - Other systems testing, if required
    - Prefinal inspection
    - Correction of punchlist from prefinal inspection
    - Final inspection

The Contractor shall create a separate sub-network related to testing and commissioning mechanical systems. As a minimum, the sub-network shall contain the information and activities as shown on Figures 1 and 2 at the end of this Section. Failure to furnish this separate sub-network within

the same time frame required for the Initial Project Schedule submission (see paragraph "Initial Project Schedule Submission") shall be cause for the Government to hold retainage up to the maximum allowed by contract, each payment period, until the sub-network is received, reviewed, and approved.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from notice-to-proceed to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date that the Notice to Proceed (NTP) was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity call "End Project". The "End Project" activity shall have: a "LF" constraint, a constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted at every project schedule update period to assist the Contracting Officer to evaluate the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" were "X" refers to the phase of work. "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in progress or completed activity and ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) shall be allowed only by the case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 10 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after Notice to Proceed.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after Notice to Proceed. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative, is necessary for verifying the contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Initial Project Schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer.

3.5 SUBMISSION REQUIREMENTS

The as noted in paragraph 1.1 items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on CD-R disks, formatted to hold 650 MB of data.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the version used to prepare the C.P.M.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the critical path, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in-progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the Notice to Proceed until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), Earnings to Date.

3.5.4.5 Cash Flow Report

A report showing scheduled cost of work-in-place by week (tabular report) and a cash flow curve by week (S-curve plot), both based on early dates.

3.5.5 Network Diagram

The time scaled network diagram shall be required on the initial schedule submission and on quarterly update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity or event number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity

sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves shall be provided showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly on-site meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor will describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost to Date shall be subject to the approval of the Contracting Officer. The following minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed activities.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment shall be based on earnings for each in-progress or completed activity. Payment for individual activities shall not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to Notice to Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities are those delays beyond the Contractors control such as strikes and unusual weather. Also included are delays encountered due to submittals, Government Activities, deliveries or work stoppage which makes re-planning the work necessary, and when the schedule does not represent the actual prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension, shall be based upon the project schedule updates in effect for the time period in question and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, shall not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under two weeks based upon the most recent schedule update at the time of the Notice to Proceed or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any request for time extension for over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If Notice to Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until the Contractor submits revisions, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, then the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor will continue to update their schedule with the Contracting Officer's revisions until a mutual agreement in the revisions may be made. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

3.10 NAS DATA

The Contractor shall provide the Government with the means to electronically transfer all required NAS data into the Resident Management System (RMS) program using the Standard Data Exchange Format (SDEF). The Contractor may use network analysis software different from that used by the Contracting Officer in the Resident Office, however, the Contractor shall also furnish the following:

NAS data that complies with the Standard Data Exchange Format (SDEF). This is a standard ASCII format for exchanging scheduling data and is compatible with our resident management system. Many software developers

provide the capability to convert and export schedule data to the SDEF at no additional cost. The SDEF specifications are in a separate publication, available from the Internet http://www.usace.army.mil/search.html - Publications.

-- End of Section --

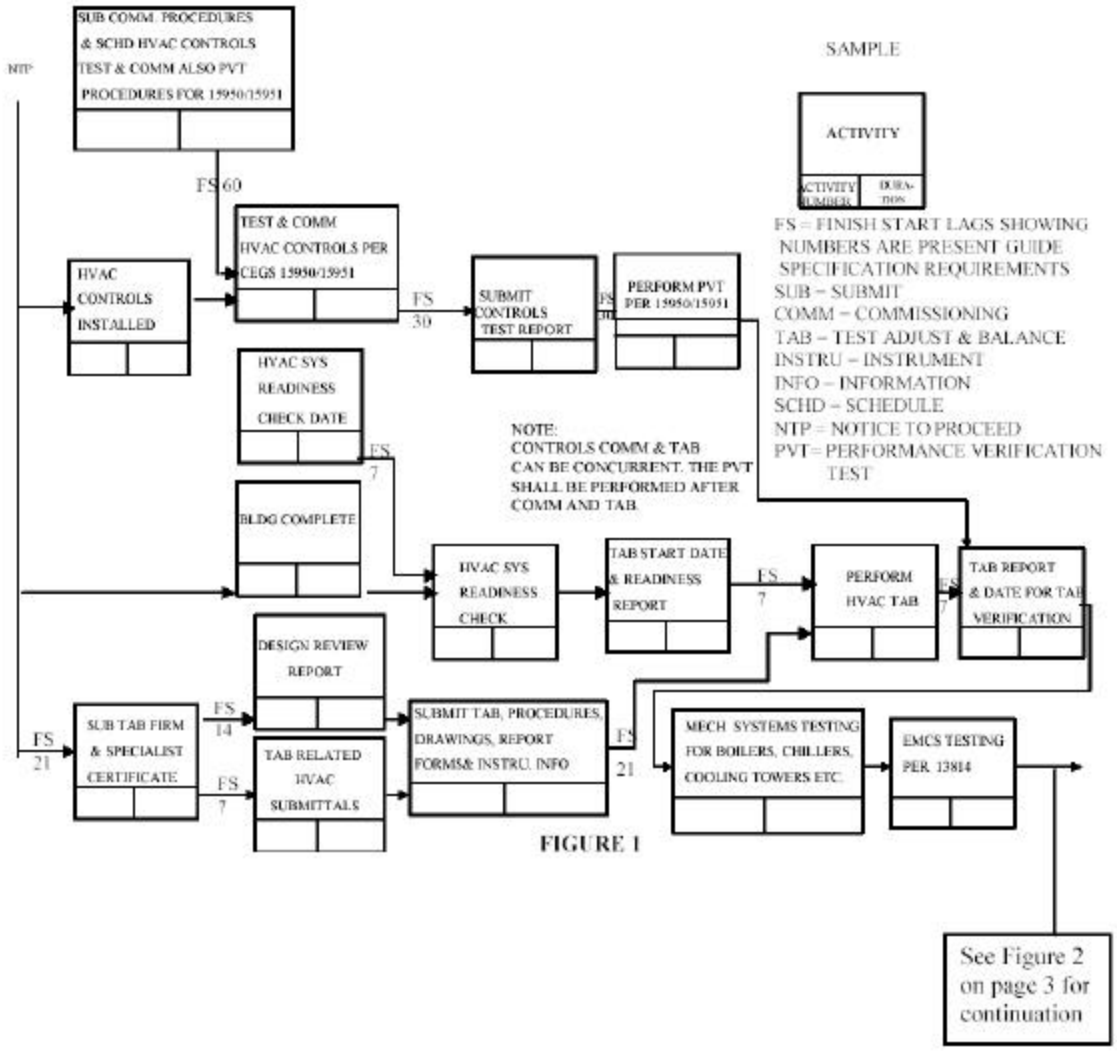
SAMPLE
ACTIVITY
ACTIVITY NUMBER
DURA-TION
FS = FINISH START LAGS SHOWING NUMBERS ARE PRESENT GUIDE SPECIFICATION REQUIREMENTS
SUB – SUBMIT
COMM – COMMISSIONING
TAB – TEST ADJUST & BALANCE
INSTRU – INSTRUMENT
INFO – INFORMATION
SCHD – SCHEDULE
NTP = NOTICE TO PROCEED
PVT = PERFORMANCE VERIFICATION TEST
NTP
SUB COMM. PROCEDURES & SCHD HVAC CONTROLS TEST & COMM ALSO PVT PROCEDURES FOR 15950/15951
FS 60
HVAC CONTROLS INSTALLED
TEST & COMM HVAC CONTROLS PER CEGS 15950/15951
FS 30
SUBMIT CONTROLS TEST REPORT
PERFORM PVT PER 15950/15951
HVAC SYS READINESS CHECK DATE
FS 7
NOTE:
CONTROLS COMM & TAB CAN BE CONCURRENT. THE PVT SHALL BE PERFORMED AFTER COMM AND TAB.
BLDG COMPLETE
HVAC SYS READINESS CHECK
TAB START DATE & READINESS REPORT
FS 7
PERFORM HVAC TAB
TAB REPORT & DATE FOR TAB VERIFICATION
DESIGN REVIEW REPORT
FS 21
SUB TAB FIRM & SPECIALIST CERTIFICATE
FS 14
FS 7
TAB RELATED HVAC SUBMITTALS
SUBMIT TAB, PROCEDURES, DRAWINGS, REPORT FORMS& INSTRU. INFO
FS 21
MECH SYSTEMS TESTING FOR BOILERS, CHILLERS, COOLING TOWERS ETC.
EMCS TESTING PER 13814
See Figure 2 on page 3 for continuation

FIGURE 1

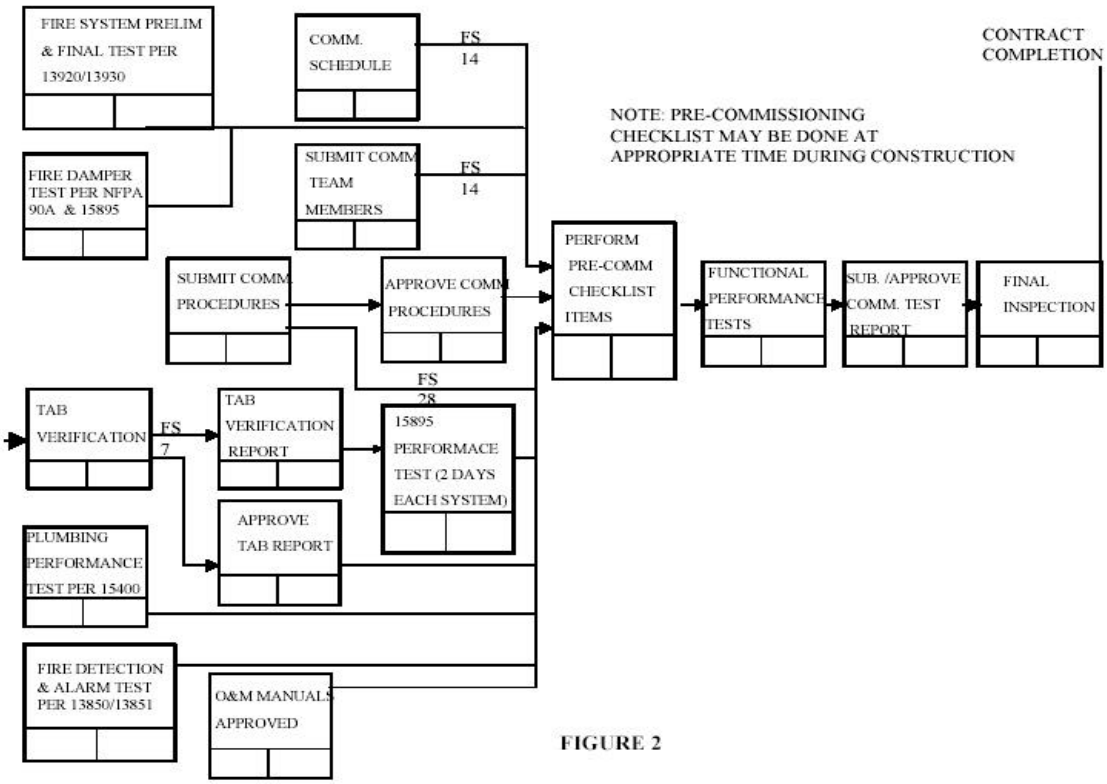

FIGURE 2

END OF SECTION

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

This section states requirements for cosntruction submittals. Design submittals shall be submitted in accordance with Section 00810, Design-Build Contract Procedures.

1.1 CONSTRUCTION SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

Final Submittal Register 4288; G

1.2 CONTROL AND SCHEDULING OF SUBMITTALS

1.2.1 Submittal Coordination Meeting

After the preconstruction conference and before any submittals are sent to the Contracting Officer's Representative (COR), the Contractor shall meet with the COR and provide and further develop the preliminary submittal register, ENG Form 4288, attached to the end of this section. The Government will provide a suitable electronic copy for import to the RMS system prior to the submittal coordination meeting. During the meeting all required items will be identified and grouped into three categories:

·Government Approved (G)

Government approval is required for extensions of design, critical materials, variations/deviations, an "or equal" decision, equipment whose compatibility with the entire system must be checked, architectural items such as Color Charts/Patterns/Textures, and other items as designated by the COR. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will be acted on as "shop drawings."

·For Information Only (FIO)
Submittals not requiring Government approval, but require submission, will be for information only. These are items such as Installation Procedures, Certificates of compliance, Samples, Qualifications, etc. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will not be acted on as "shop drawings."

·For Contractor Only (KIO)
Those items that can be visually inspected by the Contractor's Quality

Control Representative (CQC) on site or are provided to the Government other than with an ENG Form 4025: The items that fall into this category shall not be included on the register and shall not be submitted to the COR. For these items, the contractor shall maintain a separate method of tracking and make them available at the appropriate preparatory inspection(s).

1.2.2 Final Submittal Register

The final submittal register shall be coordinated with the progress schedule and submitted within 40 days of Notice to Proceed. In preparing the final document, adequate time (minimum of 30 days) shall be allowed for review and approval, and possible resubmittal of each item on the register.

1.2.3 Submittal Register Updates

The Contractor's quality control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listings shall be submitted to the COR at least every 30 days in the quantity specified.

1.3 SUBMITTAL TYPES

Throughout these specifications submittals may be identified with the prefix "SD" (submittal data) followed by a number (category, i.e., data, drawings, reports, etc.). This is for bookkeeping and record sorting in the system:

SD-01 Preconstruction Submittals

Certificates of insurance.
Surety bonds.
List of proposed subcontractors.
List of proposed products.
Construction Progress Schedule.
Submittal register.
Schedule of values.
Health and safety plan.
Work plan.
Quality control plan.
Environmental protection plan.

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data
Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-O5 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications. Confined space entry permits.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports
Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.4 APPROVED SUBMITTALS

The approval of submittals by the COR shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist. The Contractor, under the CQC requirements of this contract, is responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. After submittals have been approved by the COR, no resubmittal for the purpose of substituting materials or equipment will be given consideration.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the COR and promptly furnish a corrected submittal in the format and number of copies specified for the initial submittal. If the Contractor considers any correction

indicated on the submittals to constitute a change to the contract, written notice, as required under the Contract Clause entitled "Changes," shall be given to the COR.

1.6 PAYMENT

Separate payment will not be made for submittals, and all costs associated therein shall be included in the applicable unit prices or lump sum prices contained in the schedule. Payment will not be made for any material or equipment which does not comply with contract requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Prior to submittal, all items shall be checked and approved by the Contractor's CQC and each item of the submittal shall be stamped, signed, and dated. Each respective transmittal form (ENG Form 4025) shall be signed and dated by the CQC certifying that the accompanying submittal complies with the contract requirements. This procedure applies to all submittals. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including, but not limited to, catalog cuts, diagrams; operating charts or curves; test reports; test cylinders; samples; O&M manuals including parts lists; certifications; warranties and other such required items. Units of weights and measures used on all submittals shall be the same as the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Government-approval submittals shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. The COR may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. The Contractor shall maintain a complete and up-to-date file of all submittals/items on site for use by both the Contractor and the Government.

3.2 SUBMITTAL REGISTER (ENG Form 4288)

An electronic copy of the submittal register - ENG Form 4288 - for Divisions 1 through 16 in a format compatible for import into RMS shall be provided by the Contractor and a hard copy shall be further developed by the Contractor prior to the submittal coordination meeting and list each item of equipment and material for which submittals are required in the Technical Specifications. (See paragraph SUBMITTALS at the beginning of each specification section.)The Contractor shall approve all items listed on the submittal register. During the submittal coordination meeting, a preliminary submittal register will be created by annotating this Form 4288. When the final submittal register is submitted for approval, the Contractor shall complete the column entitled "Item No." and all data under "Contractor Schedule Dates" and return five completed copies to the COR for approval. The Contractor shall review the list to ensure its completeness and may expand general category listings to show individual entries for each item. The numbers in column "Item No." are to be assigned sequentially

starting with "1" for each specification section. DO NOT preassign transmittal numbers when preparing the submittal register. When a conflict exists between the submittal register and a submittal requirement in the technical sections, other than those submittals referenced in Paragraph 3.9: Field Test Reports, the approved submittal register shall govern. The preliminary, and then the final approved submittal register, will become the scheduling documents and will be updated monthly and used to control submittals throughout the life of the contract. Names and titles of individuals authorized by the Contractor to approve shop drawings shall be submitted to COR with the final 4288 form. Supplier or subcontractors certifications are not acceptable as meeting this requirement.

3.3 SCHEDULING

Submittals covering component items forming a system, or items that are interrelated, shall be coordinated and submitted concurrently. Certifications shall be submitted together with other pertinent information and/or drawings. Additional processing time beyond 30 days, or number of copies, may be shown by the COR on the submittal register attached in the "Remarks" column, or may be added by the COR during the coordination meeting. No delays damages or time extensions will be allowed for time lost due to the Contractor not properly scheduling and providing submittals.

3.4 TRANSMITTAL FORM (ENG Form 4025)

Transmittal Form 4025 (sample at end of this section) shall be used for submitting both Government-approval and information-only submittals in accordance with the instructions on the reverse side of the form. Transmittal numbers shall be assigned sequentially. Electronic generated 4025 forms shall be printed on carbonless paper and be a reasonable facsimile of the original 4025. If electronic forms are not used, the original 4025 forms shall be used (do not photo copy) and will be furnished by the COR. These forms shall be filled in completely prior to submittal. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.. Each submittal item shall be listed separately on the form, naming subcontractor, supplier, or manufacturer, applicable specification paragraph number(s), drawing/sheet number, pay item number, and any other information needed to identify the item, define its use, and locate it in the work. One or more 4025 forms may be used per specification section, however, DO NOT include more than one specification section per transmittal.

3.5 CROSS-REFERENCE (ENG FORM 4288/ENG FORM 4025)

To provide a cross-reference between the approved submittal register and transmittal forms, the Contractor shall record the "transmittal numbers" assigned when submitting items in column "Transmittal No." of the ENG FORM 4288. The item numbers in column "Item No." of submittal register shall correspond to the item numbers on ENG Form 4025.

3.6 SUBMITTAL PROCEDURE

3.6.1 General

Shop drawings with 4025 forms shall be submitted in the number of copies specified in subparagraphs "Government Approved Submittals" and "Information Only Submittals," or as indicated on the submittal register in the "Remarks" column. Submit a complete collated "reviewers copy" with one 4025 form and attachments (not originals). The remaining copies (4 for Government-approval, 2 for information-only) of 4025 forms and attachments shall not be collated. This would not apply to a series of drawings.

3.6.2 Approval of Submittals by the Contractor

Before submittal to the COR, the Contractor shall review and correct shop drawings prepared by subcontractors, suppliers, and itself, for completeness and compliance with plans and specifications. The Contractor shall not use red markings for correcting material to be submitted. Red markings are reserved for COR's use. Approval by the Contractor shall be indicated on each shop drawing by an approval stamp containing information as shown in this section. Submittals not conforming to the requirements of this section will be returned to the Contractor for correction and resubmittal.

3.6.3 Variations

For submittals which include proposed variations requested by the Contractor, column "h" of ENG Form 4025 shall be checked and the submittal shall be classified as G, and submitted accordingly. The Contractor shall set forth in writing the justification for any variations and annotate such variations on the transmittal form in the REMARKS block. Variations are not approved unless there is an advantage to the Government. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

3.6.4 Drawings

Each drawing shall be not larger than A1 size (841 mm wide by 594 mm high), with a title block in lower right hand corner and a 75 mm by 100 mm (3 by 4 inch) clear area adjacent. The title block shall contain the subcontractor's or fabricator's name, contract number, description of item(s), bid item number, and a revision block. Provide a blank margin of 20 mm (3/4 inch) at bottom, 50 mm (2 inches) at left, and 10 mm (1/2 inch) at top and right. Where drawings are submitted for assemblies of more than one piece of equipment or systems of components dependent on each other for compatible characteristics, complete information shall be submitted on all such related components at the same time. The Contractor shall ensure that information is complete and that sequence of drawing submittal is such that all information is available for reviewing each drawing. Drawings for all items and equipment, of special manufacture or fabrication, shall consist of complete assembly and detail drawings. All revisions after initial submittal shall be shown by number, date, and subject in revision block.

3.6.4.1 Submittals Containing Drawings Larger than A3 size, (297 mm high by 420 mm wide)

For Government-approval submittals containing drawings larger than A3 size,

one reproducible and one blue line copy will be required to be submitted with five copies of the ENG Form 4025. The marked-up reproducible (and/or any review comments contained on the page-size comment sheet(s) at the Government's option) will be returned to the Contractor upon review. The Contractor shall provide three copies of blue line drawings (generated from the reviewed reproducible) to the Government within 10 days of Contractor's receipt of the reviewed reproducible. The Contractor shall not incorporate approved work into the project until the Government has received the three blue line copies. The Contractor shall use the marked-up reproducible to make any additional copies as needed. For information-only submittals, one reproducible and two blue line copies shall be submitted with the appropriate number of copies of ENG Form 4025.

3.6.5 Printed Material

All requirements for shop drawings shall apply to catalog cuts, illustrations, printed specifications, or other data submitted, except that the 75 mm by 100 mm (3 inch by 4 inch) clear area adjacent to the title block is not mandatory. Inapplicable portions shall be marked out and applicable items such as model numbers, sizes, and accessories shall be indicated by arrow or highlighted.

3.7 SAMPLES REQUIRING LABORATORY ANALYSIS

See Section 01451CONTRACTOR QUALITY CONTROL for procedures and address for samples requiring Government testing.

3.8 SAMPLES REQUIRING VISUAL INSPECTION

Samples requiring only physical inspection for appearance and suitability shall be coordinated with the on-site Government quality assurance representative (QAR).

3.9 FIELD TEST REPORTS

Routine tests such as soil density, concrete deliveries, repetitive pressure testing shall be delivered to the QAR with the daily Quality Control reports. See SECTION: 01451 CONTRACTOR QUALITY CONTROL.

3.10 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.11 GOVERNMENT APPROVED SUBMITTALS (G)

The Contractor shall submit 5 copies of G submittals with 5 corresponding 4025 forms. Upon completion of G submittal review, copies as specified below will be marked with an action code, dated, and returned to the Contractor. See "Drawings" above for special instructions if drawings larger than size A3 (11 inch by 17 inch) are used.

3.11.1 Processing of G Submittals

Submittals will be reviewed and processed as follows:

a. Approved as Submitted (Action Code "A"): Shop drawings which can be approved without correction will be stamped "Approved" and two copies will be returned to the Contractor. No resubmittal required.

b. Approved Except as Noted (Action Code "B"): Shop drawings which have only minor discrepancies will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted" and two copies returned to the Contractor for correction. No resubmittal required.

c. Approved Except as Noted (Action Code "C"): Shop drawings which are incomplete or require more than minor corrections will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted - Resubmission Required" and two copies returned to the Contractor for correction. Resubmittal of only those items needing correction required.

d. Disapproved (Action Code "E"): Shop drawings which are fundamentally in error, cover wrong equipment or construction, or require extensive corrections, will be returned to the Contractor stamped "Disapproved." An explanation will be furnished on the submitted material or on ENG Form 4025 indicating reason for disapproval. Complete resubmittal required.

e. Resubmittal will not be required for shop drawings stamped "A" or "B" unless subsequent changes are made by Contractor or a contract modification. For shop drawings stamped "C" or "E," Contractor shall make corrections required, note any changes by dating the revisions to correspond with the change request date, and promptly resubmit the corrected material. Resubmittals shall be associated with the "parent" by use of sequential alpha characters (for example, resubmittal of transmittal 8 will be 8A, 8B, etc). Government costs incurred after the first resubmittal may be charged to the Contractor.

3.12 INFORMATION ONLY SUBMITTALS

The Contractor shall submit three copies of data and four copies of ENG Form 4025. Information-only submittals will not be returned. Government approval is not required on information-only submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the Contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the COR from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

3.12.1 Processing of Information-Only Submittals

Information-only submittals shall be submitted prior to delivery of the material or equipment to the job site. ENG Form 4025 shall be marked with the words "contractor approved - information copy only" in the REMARKS block of the form. Submittals will be monitored and spot checks made. When such checks indicate noncompliance, the Contractor will be notified by the same method used for Government-approval submittals. Resubmittal of nonconforming information-only submittals shall be reclassified Government-approval and shall be in five copies.

3.13 CONTRACTOR APPROVAL STAMP

The stamp used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR: _____

CONTRACT NUMBER _____

TRANSMITTAL NUMBER _____

ITEM NUMBER _____

SPECIFICATION SECTION _____

PARAGRAPH NUMBER _____

_____ APPROVED AS SUBMITTED

_____ APPROVED WITH CORRECTIONS AS NOTED

SIGNATURE: _____

TITLE: _____ DATE _____

-- End of Section --

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE

TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:

FROM:

CONTRACT NO.

CHECK ONE:
☐ THIS IS A NEW TRANSMITTAL
☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*

PROJECT TITLE AND LOCATION

CHECK ONE: THIS TRANSMITTAL IS FOR ☐ FID ☐ GOV'T. APPROVAL

ITEM NO. *a.*	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* *b.*	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* *c.*	NO. OF COPIES *d.*	CONTRACT REFERENCE DOCUMENT: SPEC. PARA. NO. *e.*	CONTRACT REFERENCE DOCUMENT: DRAWING SHEET NO. *f.*	FOR CONTRACTOR USE CODE *g.*	VARIATION *(See instruction No. 8)* *h.*	FOR CE USE CODE *i.*

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY

DATE

ENG FORM 4025-R, MAR 95 *(ER 415-1-10)* EDITION OF SEP 93 IS OBSOLETE. SHEET ___ OF ___ (Reverse - CEMPCD)

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.

4. Submittals requiring expeditious handling will be submitted on a separate form.

5. Separate transmittal form will be used for submittals under separate sections of the specifications.

6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG Form 4025-R)

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(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01001	SD-01 Preconstruction Submittals															
			Initial Project Schedule	1.2	G													
			CONSTRUCTION PROGRESS		G													
			CHARTS AND STATUS REPORTS															
			Contractor's progress schedule	1.14	G													
			Monthly Project Status Report		G													
			training plan	1.6.2	G													
			MECHANICAL AND ELECTRICAL	1.7														
			LAYOUT DRAWINGS															
			SD-07 Certificates															
			qualifications of the trainer	1.6.2	G													
			SD-10 Operation and Maintenance															
			Data															
			AUDIO-VIDEO RECORDINGS	1.6	G													
		01320	SD-07 Certificates															
			Preliminary project schedule, two		G													
			(2) copies															
			initial project schedule, two (2)		G													
			copies															
			Periodic schedules updates,															
			monthly updates two (2) copies															
			SD-08 Manufacturer’s Instructions															
			Qualifications		G													
		01335	SD-01 Preconstruction Submittals															
			LEED Accredited Professional		G													

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		01335	List of Proposed Products for		G													
			Attainment of LEED Credits															
			LEED Documentation		G													
			Compliance Plan															
			Miscellaneous Plans		G													
			SD-02 Shop Drawings															
			Materials, Products and		G													
			Processes															
			SD-03 Product Data															
			Products Used to Attain LEED		G													
			Credits															
			SD-05 Design Data															
			Documentation Notebook		G													
			Design Data		G													
			LEED Templates and Calculators		G													
			SD-06 Test Reports															
			Laboratory Testing		G													
			Job Site Tests and Samples		G													
			Commissioning, Acceptance and		G													
			Operational Tests															
			SD-07 Certificates															
			Manufacturer Certification		G													
			Designer Certification		G	G												
		01355	SD-01 Preconstruction Submittals															
			Environmental Protection Plan	1.10	G													
			EC-TB-ET, PM-PL-ER															

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		01355	The environmental protection plan															
			SD-06 Test Reports															
			Hazardous Materials and Hazardous Wastes															
			Hazardous Materials Inventory Form															
			Material Safety Data Sheets (MSDSs)															
			Hazardous Waste Profile Sheets															
			Hazardous Waste Accumulation Log															
			Hazardous Waste Manifest															
		01356	SD-07 Certificates															
			Mill Certificate or Affidavit	2.1.3														
		01451	SD-01 Preconstruction Submittals															
			CQC Laboratory Validation		G													
			Quality Control Plan	3.2	G													
		01452	SD-07 Certificates															
			Special Inspector	1.2	G													
			Quality Assurance Plan	1.3	G													
		01501	SD-01 Preconstruction Submittals															
			Temporary Power Services Diagram		G													
		01525	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.8	G													

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		01525	Activity Hazard Analysis (AHA)	1.9	G													
			Crane Critical Lift Plan	1.8.1	G													
			Crane Work Plan		G													
			Proof of qualification	3.5.3	G													
			SD-06 Test Reports															
			Reports	1.13														
			Accident Reports	1.13.1														
			Monthly Exposure Reports	1.13.3														
			Regulatory Citations and	1.13.4														
			Violations															
			Crane Reports	1.13.5														
			SD-07 Certificates															
			Confined Space Entry Permit	1.10														
		01701	SD-10 Operation and Maintenance															
			Data															
			Mechanical Operations and		G													
			Maintenance Manuals															
			Electrical Operations and		G													
			Maintenance Manuals															
			Fire Protection/Security		G													
			Operations and Maintenace															
			Manuals															
			Architectural/Other Operations		G													
			and Maintenace Manuals															
			Preliminary O&M Manual and															
			Data															

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		01702	SD-01 Preconstruction Submittals															
			Red Line Drawings		G													
		01703	SD-01 Preconstruction Submittals															
			Warranty Management Plan		G													
			Warranty Tags		G													
		02220	SD-07 Certificates															
			Demolition plan	1.10	G													
			Notifications	1.4.1														
			G.															
			SD-11 Closeout Submittals															
			Receipts															
		02231	SD-03 Product Data															
			Materials other than Salable															
			Timber															
			Information only.															
		02300	SD-01 Preconstruction Submittals															
			Shoring	3.3	G													
			Dewatering Work Plan	1.6	G													
			SD-03 Product Data															
			Utilization of Excavated Materials	3.7	G													
			Shoulder Construction	3.13														
			SD-06 Test Reports															
			Testing	3.16														
			Borrow Site Testing															
			SD-07 Certificates															
			Testing	3.16														

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		02373	SD-07 Certificates															
			Geotextile															
		02510	SD-03 Product Data															
			Installation	3.1														
			Waste Water Disposal Plan	3.2	G													
			Satisfactory Installation	3.4														
			SD-06 Test Reports															
			Bacteriological Disinfection															
			SD-07 Certificates															
			Manufacturer's Representative	1.3														
			Installation	3.1														
		02521	SD-02 Shop Drawings															
			Installation Diagrams		G													
			SD-03 Product Data															
			Well Installation Plan	1.5	G													
			Well Material	2.1														
			Qualifications	1.6														
			Site Conditions															
			Geophysical Logging															
			SD-06 Test Reports															
			Survey Maps and Notes															
			Well Development Records															
			Geophysical Logs															
			Decommissioning/Abandonment	3.7														
			Records															
			Project Photographs															

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		02521	Water Source															
			Tests															
			SD-07 Certificates															
			Casing	2.1														
			Cement and Bentonite Grout	2.3														
			Air line and gauge	1.5														
			Water removed															
		02531	SD-02 Shop Drawings															
			Precast concrete manhole	2.3.1														
			Metal items	2.3.4														
			Frames, covers, and gratings	2.3.4.1														
			SD-03 Product Data															
			Pipeline materials	2.1														
			SD-07 Certificates															
			Portland Cement	2.2.2														
		02620	SD-03 Product Data															
			Leaching Chamber															
			SD-08 Manufacturer's Instructions															
			Installation Procedures															
		02630	SD-03 Product Data															
			Placing Pipe	3.3														
			SD-07 Certificates															
			Resin Certification	2.1.3														
			Resin Certification	2.1.4														
			Pipeline Testing	3.8														

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		02630	Hydrostatic Test on Watertight	2.7														
			Joints															
			Determination of Density															
			Frame and Cover for Gratings	2.3.4														
		02722	SD-03 Product Data															
			Plant, Equipment, and Tools	1.6														
			SD-06 Test Reports															
			Sampling and testing	1.4	G	RE												
			Field Density Tests	1.4.2.4														
		02726	SD-03 Product Data															
			Equipment	1.5														
			Equipment	1.5														
			Equipment	3.3.5														
			Equipment	3.3.5														
			Proposed Techniques		G													
			Samples for Mixture Proportioning		G													
			Studies															
			SD-06 Test Reports															
			Sampling and Testing	1.3	G													
			Qualifications		G													
		02741	SD-03 Product Data															
			Mix Design	2.3	G	RE												
			Contractor Quality Control	3.10	G													
			RE															
			Material Acceptance and Percent		G													
			Payment															

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(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02741	SD-04 Samples															
			Asphalt Cement Binder	2.2														
			Aggregates	2.1														
			SD-06 Test Reports															
			Aggregates	2.1	G	RE												
			QC Monitoring	3.10.3.10	G	RE												
			SD-07 Certificates															
			Asphalt Cement Binder	2.2	G	RE												
			Testing Laboratory	3.6	G	RE												
		02748	SD-03 Product Data															
			Waybills and Delivery Tickets															
			SD-06 Test Reports															
			Sampling and Testing	3.7														
		02763	SD-03 Product Data															
			Equipment	1.4	G													
			Composition Requirements															
			Qualifications	1.7														
			SD-06 Test Reports															
			Sampling and Testing	2.2														
			SD-07 Certificates															
			Volatile Organic Compound															
			(VOC)															
		02770	SD-03 Product Data															
			Concrete	2.1														
			Concrete Pattern:															
			G: ED															

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		02770	Concrete Color:															
			Concrete Texture:															
			SD-04 Samples															
			Imprinted Concrete Patterning Tool:															
			G: RE															
			Concrete Paving Blocks															
			G: ED															
			SD-06 Test Reports															
			Field Quality Control	3.9														
		02811	SD-02 Shop Drawings															
			Sprinkler System	3.1														
			SD-03 Product Data															
			Framed Instructions	3.3	G													
			Field Training	3.4	G													
			Sprinkler System	3.1	G													
			Spare Parts		G													
			SD-06 Test Reports															
			Field Tests	3.2	G													
			SD-07 Certificates															
			Sprinkler System	3.1	G													
			SD-10 Operation and Maintenance Data															
			Sprinkler System	3.1	G													
		02821	SD-07 Certificates															
			Chain Link Fence	2.1.1														

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(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02870	SD-02 Shop Drawings															
			Site Furnishing Standards															
			SD-03 Product Data															
			Site Furnishings	1.4	G													
			Installation	3.1														
			SD-04 Samples															
			Finish															
			SD-06 Test Reports															
			Recycled Material	2.1.5														
		02921	SD-03 Product Data															
			Equipment															
			Surface Erosion Control Material	2.7														
			Chemical Treatment Material	1.4.3														
			Delivery	1.4.1														
			Finished Grade and Topsoil		G													
			Subgrade and Topsoil	3.2.1	G													
			Quantity Check	3.5														
			Seed Establishment Period	3.10														
			Maintenance Record		G													
			Application of Pesticide	3.6	G													
			SD-04 Samples															
			Delivered Topsoil		G													
			Soil Amendments	2.3	G													
			Mulch	2.4	G													
			SD-06 Test Reports															
			Equipment Calibration	3.1.3														

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(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02921	Soil Tests		G													
			SD-07 Certificates															
			Seed	2.1	G													
			Topsoil	2.2	G													
			pH Adjuster	2.3.1														
			Fertilizer	2.3.2														
			Organic Material	2.3.3														
			Soil Conditioner	2.3.4														
			Mulch	2.4	G													
			Asphalt Adhesive															
			Pesticide	2.6	G													
		02922	SD-03 Product Data															
			Equipment															
			Chemical Treatment Material	1.3.3.2														
			Delivery	1.3.1	G													
			Finished Grade and Topsoil		G													
			Quantity Check	3.4	G													
			Sod Establishment Period	3.9	G													
			Maintenance Record		G													
			Application of Pesticide	3.5	G													
			SD-04 Samples															
			Delivered Topsoil	1.3.1.2	G													
			Soil Amendments	2.3	G													
			SD-06 Test Reports															
			Equipment Calibration															
			Soil Test	3.1.3	G													

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		02922	SD-07 Certificates															
			Sod	2.1	G													
			Topsoil	2.2	G													
			pH Adjuster															
			Fertilizer															
			Organic Material															
			Soil Conditioner															
			Pesticide	2.5	G													
			Mulch		G													
		02930	SD-03 Product Data															
			Geotextile	2.5														
			Chemical Treatment Material	1.4.3.2														
			Equipment	3.7.2														
			Delivery	1.4.1														
			Plant Establishment Period	3.9														
			Maintenance Record	3.9.2.6														
			Application of Pesticide	3.7	G													
			SD-04 Samples															
			Delivered Topsoil	1.4.1.3	G													
			Soil Amendments		G													
			Mulch	2.4	G													
			Geotextile	2.5														
			Rock Mulches		G													
			Large Landscape Rock:		G													
			SD-06 Test Reports															
			Soil Test	2.2	G													

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		02930	Soil Test	3.1.3.2	G													
			Percolation Test	3.1.3.1														
			SD-07 Certificates															
			Plant Material	2.1	G													
			Topsoil	2.2	G													
			pH Adjuster	2.3.1														
			Fertilizer	2.3.2														
			Organic Material	2.3.3														
			Soil Conditioner	2.3.4														
			Organic Mulch	2.4.2	G													
			Pesticide	2.9	G													
			Large Landscape Rock:		G													
			SD-10 Operation and Maintenance															
			Data															
			Maintenance Instructions															
		02935	SD-03 Product Data															
			Chemical Treatment Material	1.3.3														
			Application of Pesticide	3.5	G													
			SD-06 Test Reports															
			Soil Tests	3.1	G													
			SD-07 Certificates															
			Plant Material		G													
			Topsoil		G													
			pH Adjuster															
			Fertilizer															
			Organic Material															

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		02935	Mulch		G													
			Pesticide		G													
			SD-10 Operation and Maintenance															
			Data															
			Plant Establishment Period		G													
			Work Plan and Schedule		G													
			Delivery Schedule	1.3.1	G													
			Maintenance Record	3.6.4	G													
		03100	SD-02 Shop Drawings															
			Formwork															
			SD-03 Product Data															
			Form Releasing Agents		G	G												
		03150	SD-02 Shop Drawings															
			Waterstops		G													
			SD-03 Product Data															
			Preformed Expansion Joint Filler															
			Sealant															
			Waterstops															
			SD-04 Samples															
			Lubricant for Preformed															
			Compression Seals															
			Field-Molded Type															
			Non-metallic Materials															
			Preformed Expansion Joint Filler		G													
			Sealant		G													
			Waterstops		G													

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		03200	SD-02 Shop Drawings															
			Reinforcement		G													
			SD-03 Product Data															
			Welding		G													
			SD-07 Certificates															
			Reinforcing Steel		G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		03300	SD-03 Product Data															
			Mixture Proportions	1.8	G													
			SD-06 Test Reports															
			Testing and Inspection for		G													
			Contractor Quality Control															
			SD-07 Certificates															
			Qualifications	1.6	G													
			Recycled Content		G													
			Resource Reuse		G													
			Manufacturing Plant Location		G													
			Regional Material Extraction		G													
		03312	SD-02 Shop Drawings															
			Polished Concrete:															
			SD-04 Samples															
			Materials; G															
			Appearance Samples; G															
			Mock Up Panels; G															

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		03312	Recycled Content		G													
			Manufacturing Plant Location		G													
		03330	SD-02 Shop Drawings															
			Architectural Concrete		G													
			SD-04 Samples															
			Materials	2.1	G													
			Surfaces		G													
			Recycled Content		G													
			Resource Reuse		G													
			Manufacturing Plant Location		G													
			Regional Material Extraction		G													
		03413	SD-02 Shop Drawings															
			Architectural Precast Concrete		G													
			System															
			SD-03 Product Data															
			Calculations	1.6.5														
			Mix Design	1.6.6	G													
			Manufacturer's Qualifications	1.3														
			SD-04 Samples															
			Precast Concrete Units	2.2	G													
			SD-06 Test Reports															
			Materials	2.1														
			SD-07 Certificates															
			Manufacturing Location		G													
			Certification															
		04850	SD-02 Shop Drawings															

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		04850	Detail Drawings	1.8	G													
			SD-03 Product Data															
			Clay or Shale Brick	2.1.1	G													
			Insulation		G													
			Flashing		G													
			Water-Repellant Admixture		G													
			SD-04 Samples															
			Expansion Joint Materials		G													
			Clay or Shale Brick	2.1.1	G													
			Sample Panel		G													
			SD-05 Design Data															
			Masonry Veneer/Wood Stud Wall System		G													
			calculations	3.1	G													
			SD-07 Certificates															
			Clay or Shale Brick	2.1.1														
			Joint Reinforcement	2.4														
			Expansion Joint Materials															
			Cavity Insulation	2.6														
			Exterior Sheathing	2.7														
			Air and Moisture Barrier	2.8.1														
			Veneer Anchors	2.9														
			Welding	2.10.2	G G													
		05090	SD-03 Product Data															
			Welding Procedure Qualifications	1.5	G													

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		05090	Welder, Welding Operator, and Tacker Qualification	1.5.1	G													
			Welder, Welding Operator, and Tacker Qualification	1.6	G													
			Welder, Welding Operator, and Tacker Qualification	1.6.1	G													
			Welder, Welding Operator, and Tacker Qualification	1.6.1	G													
			Inspector Qualification	1.7	G													
			Previous Qualifications	1.5.1	G													
			Prequalified Procedures	1.3.1	G													
			Prequalified Procedures	1.5.2	G													
			SD-06 Test Reports															
			Quality Control	1.5.1	G													
			Quality Control	1.6.1	G													
			Quality Control	3.2	G													
			Quality Control	3.4	G													
		05091	SD-03 Product Data															
			Ultrasonic Inspection	1.8.1	G													
			Ultrasonic Inspection	1.8.1	G													
			Ultrasonic Inspection	1.8.1	G													
			Ultrasonic Inspection	1.8.1	G													
			Ultrasonic Inspection	3.3	G													
			Ultrasonic Inspection	3.3	G													
			Ultrasonic Inspection	3.3	G													
			Ultrasonic Inspection	3.3	G													

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		05120	SD-02 Shop Drawings															
			Fabrication drawings	1.5.1	G													
			SD-03 Product Data															
			Shop primer; FIO															
			Load indicator washers; FIO															
			SD-07 Certificates															
			Steel	2.1														
			Bolts, nuts, and washers	2.2														
			Shop primer	2.4														
			Welding electrodes and rods	2.3.1														
			Nonshrink grout	2.3.2														
			AISC Quality Certification	1.4														
			Welding procedures and qualifications	1.5.2.1														
		05300	SD-02 Shop Drawings															
			Deck Units	1.4	G													
			Deck Units	1.4	G													
			Deck Units	2.1	G													
			Deck Units	2.1	G													
			Accessories	2.5	G													
			Accessories	2.5	G													
			Attachments	3.2	G													
			Holes and Openings	3.3	G													
			SD-03 Product Data															
			Deck Units	1.4	G													
			Deck Units	1.4	G													

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		05300	Deck Units	2.1	G													
			Deck Units	2.1	G													
			Attachments	3.2														
			FIO															
			SD-07 Certificates															
			Deck Units	1.4														
			Deck Units	2.1														
			FIO		G	G												
			Attachments	3.2														
		05400	SD-02 Shop Drawings															
			Framing Components	1.8.1	G													
			SD-03 Product Data															
			Manufacturer's technical literature		G													
			covering products															
			SD-05 Design Data															
			Metal framing calculations	1.8.2	G													
			SD-07 Certificates															
			Cold-formed metal framing															
			Welds	3.1.1	G	G												
		05500	SD-02 Shop Drawings															
			Steeple Access Ladder		G													
			SD-03 Product Data															
			Miscellaneous Metal Items	1.7	G													
			SD-04 Samples															
			Miscellaneous Metal Items	1.7	G	G												
		06100	SD-02 Shop Drawings															

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		06100	Structural Wood Members	2.1.6	G	EC-D												
			Installation of Framing	3.1	G	EC-D												
			Nailers and Nailing Strips	3.6.4	G													
			SD-03 Product Data															
			Structural Wood Members	2.1.6	G	EC-D												
			Qualifications	1.5	G													
			SD-04 Samples															
			Structural Laminated Members		G	EC-D												
			Finish															
			SD-07 Certificates															
			Grading and Marking	2.1.1	G	G												
		06200	SD-02 Shop Drawings															
			Finish Carpentry		G													
			SD-03 Product Data															
			Wood Items, Siding and Trim		G													
			SD-04 Samples															
			Wood Bases, Chair Rail, Cornice,		G													
			and Trim															
			Panel Products (WP-1 and WP-2)		G													
			with Stains and Transparent Finish															
			Stain/Color/Finish Samples on		G	G												
			Veneer to Be Used															
		06415	SD-02 Shop Drawings															
			Shop Drawings		G													
			Installation	3.2														
			SD-03 Product Data															

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		06415	Wood Materials		G													
			Wood Finishes	2.7	G													
			Custom Wood		G													
			Finish Schedule		G													
			SD-04 Samples															
			Plastic Laminates		G													
			Cabinet Hardware		G													
			Solid Hardwood, with or for		G													
			Transparent Finish															
			Agrifiber Board Veneer Panel		G													
			Products with or for Transparent															
			Finish															
			Stain/Color/Finish Samples on		G													
			Veneer to Be Used															
			SD-07 Certificates															
			Quality Assurance		G													
			Certified Wood		G													
			Recycled Content		G													
			Rapidly Renewable Materials		G													
			Manufacturing Plant Location		G													
			Agrifiber Harvesting Location		G													
		06610	SD-02 Shop Drawings															
			Detail Drawings		G													
			SD-03 Product Data															
			Manufacturer's data sheets		G													
			SD-04 Samples															

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		06610	Finish Surface and Color		G													
			SD-07 Certificates															
			Manufacturer Qualifications		G													
			Installer Qualifications		G													
			Manufacturing Plant Location		G													
		06650	SD-02 Shop Drawings															
			Shop Drawings	1.8	G													
			Installation	3.2	G													
			SD-03 Product Data															
			Solid polymer material	2.1														
			Qualifications	1.7														
			Fabrications	2.3														
			SD-04 Samples															
			Material	2.1	G													
			Countertops	2.3.5	G													
			SD-06 Test Reports															
			Solid polymer material	2.1														
			SD-07 Certificates															
			Fabrications	2.3														
			Qualifications	1.7														
			SD-10 Operation and Maintenance															
			Data															
			Clean-up	3.4														
			Manufacturing Plant Location		G													
		07110	SD-07 Certificates															
			Materials	1.5														

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		07110	Manufacturing Plant Location		G													
		07131	SD-03 Product Data															
			Elastomeric waterproofing sheet material	2.1	G													
			Protection board	2.5														
			Primers, adhesives, and mastics	2.1														
			SD-06 Test Reports															
			Elastomeric waterproofing sheet material	2.1														
			Manufacturing Plant Location		G													
		07210	SD-03 Product Data															
			Application of Insulation;															
			Inspection;															
			Material Properties;															
			SD-07 Certificates															
			Insulation; G															
			Recycled Content		G													
			Rapidly Renewable Materials		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		07413	SD-03 Product Data															
			Wall panels	2.1	G													
			Closures	3.1.1														
			Flashing	3.1.1														
			Accessories	2.3														
			Fasteners	2.4														

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		07413	Gaskets and Insulating Compounds	2.6														
			SD-04 Samples															
			WALL PANEL	2.1	G													
			Accessories	2.3														
			Fasteners	2.4														
			Gaskets and Insulating Compounds	2.6	G													
			SD-06 Test Reports															
			Salt Spray Test	2.2.1														
			SD-07 Certificates															
			Wall Panels	2.1	G													
			Accessories	2.3														
			SD-08 Manufacturer's Instructions															
			INSTALLATION	3.1	G													
		07416	SD-02 Shop Drawings															
			Structural Standing Seam Metal Roof	1.3.1	G													
			SD-03 Product Data															
			Design Analysis	1.4	G													
			Qualifications	1.3.2														
			SD-04 Samples															
			Accessories	2.3	G													
			Roof Panels	2.1	G													
			Factory Color Finish	2.5	G													
			Fasteners	2.4														

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		07416	Gaskets and Insulating Compounds	2.8														
			Sealant	2.7														
			Concealed Anchor Clips	2.2														
			EPDM Rubber Boots	2.11														
			SD-06 Test Reports															
			Wind Uplift Resistance	1.5	G													
			SD-07 Certificates															
			Structural Standing Seam Metal Roof	1.3.1														
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
			Heat Island Effect: Roof		G													
		07530	SD-02 Shop Drawings															
			Roofing System		G													
			SD-03 Product Data															
			EPDM Sheet	2.1.1	G													
			Seam Tape	2.1.2														
			Bonding Adhesive	2.1.4	G													
			Lap Splice Adhesive	2.1.3														
			Water Cutoff Mastic/Water Block	2.1.6														
			Lap Cleaner, Lap Sealant, and Edge Treatment	2.1.5														
			Flashing	2.1.7	G													
			Flashing Accessories	2.1.7														

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		07530	Flashing Tape	2.1.7.1														
			Fasteners and Plates	2.1.8														
			PRE-MANUFACTURED	2.1.9	G													
			ACCESSORIES															
			PRE-MANUFACTURED	2.1.9	G													
			ACCESSORIES															
			warranty	1.9	G													
			Inspection		G													
			SD-07 Certificates															
			Qualification of Manufacturer	1.5.1														
			Qualification of Applicator	1.5.2														
			Wind Uplift Resistance	1.5.4	G													
			Fire Resistance	1.5.3	G													
			SD-08 Manufacturer’s Instructions															
			APPLICATION	3.3	G													
			Application Method	3.3.3	G													
			Membrane Flashing	3.3.8	G													
			Seam Tape	2.1.2														
			Tape Seams / Lap Splices	3.3.4														
			Adhesive Seams / Lap Splices	3.3.5														
			Perimeter Attachment	3.3.6														
			primer	3.3.4														
			fasteners	3.3.7														
			Pre-manufactured accessories	2.1.9														
			Pre-manufactured accessories	2.1.9														
			cold weather	1.7	G													

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		07530	SD-11 Closeout Submittals															
			WARRANTY	1.9														
			INFORMATION CARD	3.9														
			INSTRUCTIONS TO	3.8														
			GOVERNMENT PERSONNEL															
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		07600	SD-02 Shop Drawings															
			Covering on flat, sloped, or curved		G													
			surfaces															
			Gutters		G													
			Downspouts		G													
			Expansion joints		G													
			Splash pans		G													
			Flashing for roof drains		G													
			Base flashing		G													
			Counterflashing		G													
			Flashing at roof penetrations		G													
			Reglets		G													
			Scuppers		G													
			Copings, fascias and soffits		G													
			Drip edge		G													
			Conductor heads		G													
			Open valley flashing		G													
			Eave flashing		G													
			SD-03 Product Data															

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		07600	Materials		G													
			SD-04 Samples															
			Materials															
			Color Samples															
			Mock Ups															
			SD-11 Closeout Submittals															
			Quality Control Plan															
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		07725	SD-02 Shop Drawings															
			Fall Protection Anchors	1.4	G													
			Fall Protection Anchors	1.6	G													
			Fall Protection Anchors	3.1	G													
			Flashing		G													
			SD-07 Certificates															
			Fall Protection Anchors	1.4	G													
			Fall Protection Anchors	1.6	G													
			Fall Protection Anchors	3.1	G													
		07812	SD-03 Product Data															
			Fire Resistive Coating Material	3.3	G													
			SD-04 Samples															
			Fire Resistive Coating	2.1	G													
			SD-06 Test Reports															
			Fire Resistance Rating	1.7	G													
			Field Tests	3.5	G													

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		07812	SD-07 Certificates															
			Installer Qualifications	1.5	G													
			Surface Preparation Report	3.1	G													
			Manufacturer's Inspection Report	3.5.4	G													
		07840	SD-02 Shop Drawings															
			Firestopping Materials	2.1	G													
			SD-07 Certificates															
			Firestopping Materials	2.1	G													
			Installer Qualifications	1.5														
			Inspection	3.3	G													
		07920	SD-03 Product Data															
			Sealants	2.1	G													
			Primers	2.2														
			Bond breakers	2.3														
			Backstops	2.4														
			SD-07 Certificates															
			Sealant	3.3.6	G													
			VOC Emissions		G													
		08110	SD-02 Shop Drawings															
			Doors	2.1	G	G												
			Doors	2.1	G	G												
			Frames	2.6	G	G												
			Frames	2.6	G	G												
			Accessories	2.4														
			SD-03 Product Data															
			Doors	2.1	G													

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		08110	Frames	2.6	G													
			Accessories	2.4														
			SD-04 Samples															
			Factory-applied enamel finish		G													
			SD-05 Design Data															
			Calculations or test reports		G													
			SD-07 Certificates															
			Doors and Frames		G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08120	SD-02 Shop Drawings															
			Doors and frames	2.1	G													
			SD-03 Product Data															
			Doors		G													
			Frames		G													
			Accessories															
			SD-05 Design Data															
			Calculations or test reports		G													
			SD-08 Manufacturer’s Instructions															
			Doors and frames	2.1														
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08210	SD-02 Shop Drawings															
			Doors	2.1	G													

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		08210	SD-03 Product Data															
			Doors	2.1	G													
			Accessories	2.2														
			Water-resistant sealer	2.3.7														
			warranty	1.5														
			Sound transmission class rating	2.1.3	G													
			Fire resistance rating	2.1.4	G													
			SD-04 Samples															
			Doors	2.1														
			Door finish colors	2.3.6.2	G													
			SD-06 Test Reports															
			Split resistance	2.4														
			Cycle-slam	2.4														
			Hinge loading resistance	2.4														
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08329	SD-02 Shop Drawings															
			Doors, Frames and Accessories		G													
			SD-03 Product Data															
			Doors, Frames and Accessories		G													
			SD-04 Samples															
			Factory-applied finish		G													
			SD-07 Certificates															
			Doors and Frames		G													
			Recycled Content		G													

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		08329	Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08520	SD-02 Shop Drawings															
			Windows	2.1	G													
			SD-03 Product Data															
			Windows	2.1	G													
			Hardware	2.2.8.1	G													
			Fasteners	2.2.8.2	G													
			Screens	2.2.10	G													
			Weatherstripping	2.2.2	G													
			Accessories	2.2.8	G													
			SD-04 Samples															
			Finish Sample	1.4.2.1														
			Window Sample	1.4.2.2														
			SD-05 Design Data															
			Structural calculations or test		G													
			reports															
			SD-06 Test Reports															
			Minimum condensation	1.4.4														
			resistance factor															
			Resistance to static load															
			requirements															
			SD-07 Certificates															
			Aluminum Windows		G													
			SD-10 Operation and Maintenance															
			Data															

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		08520	Windows	2.1	G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08710	SD-02 Shop Drawings															
			Hardware schedule	1.3	G													
			Keying system	2.3.8														
			Electronic entry diagrams		G													
			SD-03 Product Data															
			Hardware items	2.3	G	G												
			SD-07 Certificates															
			Hardware Compliance with NFPA															
			and BHMA Standards															
			SD-08 Manufacturer's Instructions															
			Installation	3.1														
			SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.3	G													
			SD-11 Closeout Submittals															
			Key bitting	1.4														
		08800	SD-02 Shop Drawings															
			Installation		G													
			Elevation (Decorative Glass)		G													
			SD-03 Product Data															
			Insulating Glass		G													
			Decorative Glass		G													

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		08800	Glazing Accessories															
			SD-04 Samples															
			Insulating Glass		G													
			Decorative Glass		G													
			Glazing Compound															
			Glazing Tape															
			Sealant															
			SD-07 Certificates															
			Insulating Glass															
			Glazing Accessories															
			SD-08 Manufacturer’s Instructions															
			Setting and sealing materials															
			Glass setting															
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		08911	SD-02 Shop Drawings															
			Glazed curtain wall system															
			SD-03 Product Data															
			Glazed curtain wall system															
			SD-04 Samples															
			Glazed curtain wall system															
			mock-up; G															
			SD-05 Design Data															
			Structural calculations or test		G													
			reports															
			SD-08 Manufacturer’s Instructions															

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		08911	Glazed curtain wall system															
			Insulating glass															
		09100	SD-02 Shop Drawings															
			Metal support systems	2.1	GSubmi													
			SD-07 Certificates															
			Steel Framing		G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		09215	SD-02 Shop Drawings															
			Approved Detail Drawings		G													
			SD-03 Product Data															
			Gypsum base	2.1.3	G													
			Gypsum veneer plaster	2.1.4	G													
			SD-07 Certificates															
			Fire Resistive Construction		G													
		09225	SD-02 Shop Drawings															
			Stucco System															
			SD-03 Product Data															
			Materials	1.4														
			SD-04 Samples															
			Colored Stucco Finish Coat															
			SD-07 Certificates															
			Stucco Materials															
			Acrylic Finish Material:															
			Joint and Trim Materials															

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		09225	Cementitious Backer Unit															
			Weather-Resistant Barrier															
			Fasteners and Anchors		G	G												
		09250	SD-02 Shop Drawings															
			Control Joints		G													
			Fire-Resistant Assemblies		G													
			SD-03 Product Data															
			Cementitious backer units:	2.1.6	G													
			Glass Mat Water-Resistant	2.1.3														
			Gypsum Tile Backing Board															
			Water-Resistant Gypsum Backing	2.1.2														
			Board															
			Glass Mat Covered or Reinforced															
			Gypsum Sheathing															
			Glass Mat Covered or Reinforced															
			Gypsum Sheathing Sealant															
			Accessories	2.1.16														
			SD-07 Certificates															
			Asbestos Free Materials	2.1	G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
		09310	SD-03 Product Data															
			Tile	2.1	G													
			Setting-Bed	2.2	G													
			Mortar, Grout, and Adhesive	2.4	G													

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		09310	Adhesives and Sealants															
			SD-04 Samples															
			Tile	2.1	G													
			Accessories															
			SD-06 Test Reports															
			Testing															
			SD-07 Certificates															
			Tile	2.1														
			Mortar, Grout, and Adhesive	2.4														
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
			VOC Emissions		G													
		09510	SD-02 Shop Drawings															
			Approved Detail Drawings	1.4														
			SD-03 Product Data															
			Acoustical Ceiling Systems															
			SD-04 Samples															
			Acoustical Units	2.1														
			SD-06 Test Reports															
			Ceiling Attenuation Class and	1.4.1														
			Test															
			SD-07 Certificates															
			Acoustical Units	2.1														
			Recycled Content		G													
			Manufacturing Plant Location		G													

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		09510	Regionally Extracted Materials		G													
		09580	SD-02 Shop Drawings															
			Approved Detail Drawings															
			SD-03 Product Data															
			Open Grid Metal Ceiling Systems															
			SD-04 Samples															
			Grid and Panel Cells															
			SD-06 Test Reports															
			Fire Resistive Ceilings	1.3.1														
			SD-07 Certificates															
			Grid and Panel Cells															
		09640	SD-03 Product Data															
			Installation	3.2														
			SD-04 Samples															
			Strip Flooring	2.1														
			SD-07 Certificates															
			Flooring Materials		G													
			SD-08 Manufacturer’s Instructions															
			Adhesive															
			Finish															
			Polyurethane coating	3.4														
			Wax Finish															
			SD-10 Operation and Maintenance															
			Data															
			Flooring Materials		G													
		09650	SD-02 Shop Drawings															

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		09650	Resilient Flooring and	2.11	G													
			Accessories															
			SD-03 Product Data															
			Resilient Flooring and	2.11	G													
			Accessories															
			Adhesives and Sealants	2.7														
			SD-04 Samples															
			Resilient Flooring and	2.11	G													
			Accessories															
			SD-06 Test Reports															
			Moisture, Alkalinity and Bond	3.3	G													
			Tests															
			SD-08 Manufacturer's Instructions															
			Surface Preparation	3.2														
			Installation	3.1														
			SD-10 Operation and Maintenance															
			Data															
			Resilient Flooring and	2.11	G													
			Accessories															
			Recycled Content		G													
			Rapidly Renewable Materials		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
			VOC Emissions		G	G												
		09685	SD-02 Shop Drawings															
			Installation	3.4	G													

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		09685	Molding	2.3	G													
			SD-03 Product Data															
			Carpet	2.1	G													
			Surface Preparation	3.1	G													
			Installation	3.4	G													
			Adhesives															
			SD-04 Samples															
			Carpet	2.1	G													
			Molding	2.3	G													
			SD-06 Test Reports															
			Moisture and Alkalinity Tests	3.2	G													
			Flammability		G													
			Static control		G													
			Carpet and Rug Institute (CRI)		G													
			Green Label Requirements for															
			Indoor Air Quality Test Criteria															
			SD-07 Certificates															
			Carpet Tile		G													
			Installation Experience	1.6.2	G													
			Installation Firm and Installer		G													
			Approval															
			Regulatory Requirements	1.3	G													
			SD-08 Manufacturer's Instructions															
			Carpet Tile Installation		G													
			SD-10 Operation and Maintenance															
			Data															

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		09685	Carpet	2.1	G													
			Cleaning and Protection	3.5	G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
			VOC Emissions		G													
			Manufacturer's Sustainable Practices		G													
		09720	SD-03 Product Data															
			Wallcoverings and Accessories	2.1	G													
			Primer and Adhesive	2.3														
			SD-04 Samples															
			Wallcoverings and Accessories	2.1	G													
			SD-07 Certificates															
			Wallcoverings and Accessories	2.1														
			SD-08 Manufacturer’s Instructions															
			Wallcoverings and Accessories	2.1														
			SD-10 Operation and Maintenance Data															
			Wallcoverings	2.1														
			Recycled Content		G													
			Rapidly Renewable Materials		G													
			Manufacturing Plant Location		G													
			VOC Emissions		G													
		09840	SD-02 Shop Drawings															
			Approved Detail Drawings	2.1														

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		09840	SD-03 Product Data															
			Installation	3.2														
			Acoustical Wall Panels	2.1														
			Vinyl Moldings and Attachment Trim															
			SD-04 Samples															
			Acoustical Wall Panels	2.1														
			Vinyl Moldings and Attachment Trim															
			SD-07 Certificates															
			Acoustical Wall Panels	2.1														
		09900	SD-02 Shop Drawings															
			Piping identification	3.10														
			Piping identification	3.10														
			SD-03 Product Data															
			Coating	1.4.1	1.3.6.1	5												
			Coating	3.6.1	G													
			Coating	3.6.1	G													
			Coating	3.6.1	G													
			Coating	3.6.1	G													
			Coating	3.6.4	G													
			Coating	3.6.4	G													
			Coating	3.7	G													
			Coating	3.8	G													
			Coating	3.9	G													
			SD-04 Samples															

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		09900	Color		G													
			SD-07 Certificates															
			Qualification Testing laboratory		G													
			for coatings															
			SD-08 Manufacturer’s Instructions															
			Mixing															
			Manufacturer's Material Safety															
			Data Sheets															
			SD-10 Operation and Maintenance															
			Data															
			Coatings		G													
			coating	1.4.1	1.3.6.1													
			coating	3.6.1														
			coating	3.6.1														
			coating	3.6.1														
			coating	3.6.1														
			coating	3.6.4														
			coating	3.6.4														
			coating	3.7														
			coating	3.8														
			coating	3.9														
			Manufacturing Plant Location		G													
			Regionally Extracted Materials		G													
			VOC Emissions		G													
		09915	SD-04 Samples															
			Color Schedule															

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		10100	SD-03 Product Data															
			Visual Display Boards		G													
			Projection Screens		G													
			SD-04 Samples															
			Aluminum	2.2.5	G													
			Porcelain Enamel	2.2.1	G													
			Materials	2.2	G													
			07 Certificates															
			Visual Display Boards															
		10153	SD-02 Shop Drawings															
			Installation	3.1	G													
			SD-03 Product Data															
			Toilet Partition System;	1.3	G													
			SD-04 Samples															
			Colors and Finishes;	2.3	G													
		10201	SD-02 Shop Drawings															
			Wall louvers	2.2														
			SD-03 Product Data															
			Louvers and Vents; G															
			Finishes; G															
			Accessory Items; G															
			SD-04 Samples															
			Wall louvers	2.2	G													
			Door louvers		G													
			Recycled Content		G													
			Manufacturing Plant Location		G													

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		10201	Regionally Extracted Materials		G													
		10260	SD-02 Shop Drawings															
			Corner Guards	2.2														
			Wall Guards (Bumper Guards)															
			SD-03 Product Data															
			Corner Guards	2.2														
			Wall Guards (Bumper Guards)															
			SD-04 Samples															
			Finish	2.3														
			SD-06 Test Reports															
			Corner Guards	2.2	G													
			Wall Guards (Bumper Guards)		G													
			SD-07 Certificates															
			Corner Guards	2.2														
			Wall Guards (Bumper Guards)															
		10430	SD-02 Shop Drawings															
			Approved Detail Drawings	3.1	G													
			SD-03 Product Data															
			Exterior Signage Systems;	2.2	G													
			Installation	3.1														
			Exterior Signage Schedule		G													
			Wind Load Requirements	1.4														
			SD-04 Samples															
			Exterior Signage	1.3	G													
			SD-10 Operation and Maintenance															
			Data															

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		10430	Protection and Cleaning	3.1.2														
		10440	SD-02 Shop Drawings															
			Detail Drawings	3.1														
			SD-03 Product Data															
			Installation	3.1														
			SD-04 Samples															
			Interior Signage	1.3														
			SD-10 Operation and Maintenance															
			Data															
			Approved Manufacturer's	3.1														
			Instructions															
			Protection and Cleaning	3.1.2														
		10520	SD-02 Shop Drawings															
			FIRE EXTINGUISHER CABINETS	2.2	G													
			SD-03 Product Data															
			FIRE EXTINGUISHER CABINETS	2.2	G													
			SD-07 Certificates															
			FIRE EXTINGUISHER CABINETS	2.2	G													
		10650	SD-02 Shop Drawings															
			Installation Procedure		G													
			Wiring Diagrams	2.5.1	G													
			Layouts	3.1.1	G													
			SD-03 Product Data															
			Operable Partitions	1.2	G													
			SD-04 Samples															
			Operable Partitions	1.2	G													

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		10650	Full range of color, pattern, fabrics		G													
			and trim available															
			SD-06 Test Reports															
			Acoustical Test	3.2.3	G													
			Flame and Smoke Development		G													
			Tests															
			SD-07 Certificates															
			Materials	2.1	G													
			Operable Partitions	1.2	G													
			SD-10 Operation and Maintenance															
			Data															
			Operable Partitions	1.2														
		10655	SD-02 Shop Drawings															
			Partition layouts	3.1.1	G													
			SD-03 Product Data															
			Framework	2.4.1														
			Suspension system	2.4.2														
			Covering	2.4.3														
			Installation and Operating															
			Instructions															
			SD-04 Samples															
			Covering	2.4.3	G													
			Full range of color, pattern, fabrics		G													
			and trim available															
			SD-06 Test Reports															

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		10655	Laboratory Acoustical	2.3.2	G													
			Requirements															
			Acoustical test	3.2.3	G													
			SD-10 Operation and Maintenance															
			Data															
			Folding partitions	2.1	G													
		10800	SD-03 Product Data															
			Finishes	2.1.2														
			Accessory Items	2.2														
			SD-04 Samples															
			Finishes	2.1.2	G													
			Accessory Items	2.2														
			SD-07 Certificates															
			Accessory Items	2.2														
			SD-10 Operation and Maintenance															
			Data															
			Electric Hand Dryer															
		10990	SD-02 Shop Drawings															
			TV/VCR WALL MOUNTING		G													
			BRACKET															
			RECESSED FLOOR MATS	2.2	G													
			EXTERIOR CLOCK		G													
			RECESSED PROJECTOR		G													
			PLATFORM															
			SD-03 Product Data															

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		10990	TV/VCR SUPPORT AND WALL	2.1	G													
			MOUNTING BRACKET															
			RECESSED FLOOR MATS	2.2	G													
			EXTERIOR CLOCK		G													
			RECESSED PROJECTOR		G													
			PLATFORM															
		11452	SD-02 Shop Drawings															
			Residential Appliances		G													
			Installation		G													
			SD-03 Product Data															
			Residential Appliances		G													
			SD-06 Test Reports															
			Testing		G													
			peration and Maintenance Data															
			Residential Appliances		G													
			Recycled Content		G													
			Manufacturing Plant Location		G													
		12490	SD-02 Shop Drawings															
			Approved Detail Drawings	3.2	G													
			SD-03 Product Data															
			Window Blinds		G													
			Window Shades		G													
			Hardware	1.3														
			SD-04 Samples															
			Window Blinds		G													
			Window Shades		G													

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(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		12490	Colors		G													
		12495	SD-04 Samples															
			Curtain fabric	2.1.1.1	G													
			Finished curtain		G													
			SD-06 Test Reports															
			Flame resistance;	2.1.1.3	G													
			SD-08 Manufacturer's Instructions															
			Curtain and Track hardware															
			fabrication	2.2.1														
			SD-10 Operation and Maintenance															
			Data															
			Curtain, Track and Machine		G													
			system															
		12670	SD-02 Shop Drawings															
			Pew Construction		G													
			Installation	3.3	G													
			SD-03 Product Data															
			Pews		G													
			SD-04 Samples															
			Pews		G													
		13080	SD-02 Shop Drawings															
			Bracing	3.1														
			Resilient Vibration Isolation	3.4														
			Devices															
			Equipment Requirements	1.4														
			SD-03 Product Data															

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		13080	Bracing	3.1	G													
			Equipment Requirements	1.4	G													
		13100	SD-02 Shop Drawings															
			Drawings															
			SD-07 Certificates															
			Materials	2.1														
		13110	SD-02 Shop Drawings															
			Drawings	1.3.5	G													
			Contractor's Modifications	1.3.2	G													
			SD-03 Product Data															
			Equipment	1.3	G													
			Spare Parts	3.7														
			SD-06 Test Reports															
			Tests and Measurements	3.4														
			Contractor's Modifications	1.3.2														
			SD-07 Certificates															
			Cathodic Protection System	1.3														
			Services of 'Corrosion Expert'	1.3.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Cathodic Protection System	1.3														
			Training Course															
		13851	SD-02 Shop Drawings															
			Fire Alarm Reporting System; G.															
			SD-03 Product Data															
			Storage Batteries	2.2														

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		13851	Voltage Drop															
			Special Tools and Spare Parts	2.7.4														
			Technical Data and Computer	1.5	G													
			Software															
			Training	3.6	G													
			Testing	3.5														
			SD-06 Test Reports															
			Testing	3.5														
					06													
			SD-07 Certificates															
			Equipment		G													
			Qualifications	1.3.7														
			SD-10 Operation and Maintenance															
			Data															
			Technical Data and Computer	1.5	G													
			Software															
		13930	SD-02 Shop Drawings															
			Shop Drawings	1.12	G													
			As-Built Drawings	3.11														
			SD-03 Product Data															
			Fire Protection Related	3.1														
			Submittals															
			Sway Bracing	3.4.1	G													
			Materials and Equipment	2.3	G													
			Hydraulic Calculations	1.7	G													
			Spare Parts	1.11														

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		13930	Preliminary Tests	3.10	G													
			Final Acceptance Test	3.11	G													
			On-site Training	3.12	G													
			Fire Protection Specialist	1.8	G													
			Sprinkler System Installer	1.9	G													
			SD-06 Test Reports															
			Test of Backflow Prevention	3.10.2.2	G													
			Assemblies															
			Preliminary Test Report	3.11	G													
			Final Acceptance Test Report	3.11	G													
			SD-07 Certificates															
			Inspection by Fire Protection	3.3	G													
			Specialist															
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.12														
			Instructions															
		13965	SD-02 Shop Drawings															
			Wet Chemical Fire Extinguishing		G													
			System															
			SD-03 Product Data															
			Similar Services															
			Wet Chemical Fire Extinguishing		G													
			System															
			Preliminary Tests:		G													
			Final Acceptance Tests:	3.2	G													

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		13965	Field Training	3.3														
			SD-06 Test Reports															
			Preliminary Tests															
			Final Acceptance Tests	3.2														
			SD-07 Certificates															
			Installation Technician	1.3.4	G													
			Installation Drawings	1.3.3	G													
			SD-10 Operation and Maintenance															
			Data															
			Wet Chemical Fire Extinguishing															
			System															
		15070	SD-02 Shop Drawings															
			Coupling and Bracing	3.1														
			Flexible Couplings or Joints	3.3														
			Equipment Requirements	1.3														
			Contractor Designed Bracing	1.2.4	G													
			SD-03 Product Data															
			Coupling and Bracing	3.1	G													
			Equipment Requirements	1.3	G													
			Contractor Designed Bracing	1.2.4	G													
			SD-07 Certificates															
			Flexible Ball Joints	2.2														
		15080	SD-02 Shop Drawings															
			MICA Plates	3.2.2.4														
			SD-03 Product Data															
			General Materials	2.1														

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		15080	SD-04 Samples															
			Thermal Insulation Materials															
		15216	SD-02 Shop Drawings															
			Welding pressure piping	1.4.1														
			SD-07 Certificates															
			Welding procedures qualification	1.4.3														
			Nondestructive examination	1.4.2														
			(NDE) procedures															
			NDE personnel certification	1.4.6.2														
			procedures															
			Inspector certification	1.4.6.1														
			SD-11 Closeout Submittals															
			Weld identifications	1.4.7.1														
		15400	SD-02 Shop Drawings															
			Plumbing System	3.9.1	G													
			Electrical Work	1.4	G													
			Hot Water Heater and Circulation		G													
			System Details															
			SD-03 Product Data															
			Plumbing Fixture Schedule	3.11														
			Vibration-Absorbing Features	3.4	G													
			Plumbing System	3.9.1														
			Field Training	3.10														
			SD-06 Test Reports															
			Tests, Flushing and Disinfection	3.9														

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		15400	Test of Backflow Prevention Assemblies	3.9.1.1	G													
			SD-07 Certificates															
			Materials and Equipment	1.3														
			Bolts	2.1.1														
			SD-10 Operation and Maintenance Data															
			Plumbing System	3.9.1	G													
		15556	SD-02 Shop Drawings															
			Heating System	2.14														
			SD-03 Product Data															
			Spare Parts															
			Welding	3.3														
			Framed Instructions	3.17														
			SD-06 Test Reports															
			Testing and Cleaning	3.14														
			Water Treatment Testing	3.14.4														
			SD-07 Certificates															
			Bolts	2.2.6.3														
			SD-10 Operation and Maintenance Data															
			Heating System	2.14														
		15741	SD-03 Product Data															
			Water-source water-to-air heat pumps	2.1.1	G													

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		15741	Water-source water-to-water heat pumps	2.1.2	G													
			Plate heat exchangers	2.1.4	G													
			Specialty valves	2.3.4	G													
			Expansion tanks	2.4.7														
			Air separators	2.4.8														
			SD-06 Test Reports															
			Piping welds NDE report	1.5.4														
			Water-source water-to-air heat pumps - field acceptance test plan	3.5.2.2	G													
			Water-source water-to-water heat pumps - field acceptance test plan	3.5.2.2	G													
			Plate Heat Exchangers - field acceptance test plan	3.5.2.2	G													
			Water-source water-to-air heat pumps - field acceptance test report	3.5.2.3	G													
			Water-source water-to-water heat pumps - field acceptance test report	3.5.2.3	G													
			Plate Heat Exchangers - field acceptance test report	3.5.2.3	G													
			SD-07 Certificates															
			Employer's record documents	1.5.2														
			Welding procedures and qualifications	1.5.3														

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		15741	Qualifications of ground heat exchanger fabricators		G													
			Qualifications of ground heat exchanger installers		G													
			SD-08 Manufacturer's Instructions															
			Water-source water-to-air heat pumps - installation instructions	3.1.1														
			Water-source water-to-water heat pumps - installation instructions	3.1.1														
			Plate Heat Exchangers - installation instructions	3.1.1														
			SD-10 Operation and Maintenance Data															
			Water-source water-to-air heat pumps	2.1.1	G													
			Water-source water-to-water heat pumps	2.1.2	G													
			Plate Heat Exchangers	2.1.4	G													
		15760	SD-03 Product Data															
			Unit heaters	2.1														
			Infrared heaters															
			SD-10 Operation and Maintenance Data															
			Unit heaters	2.1														
			Infrared heaters															
		15895	SD-02 Shop Drawings															

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		15895	Drawings	3.1.2														
			Installation	3.1														
			SD-03 Product Data															
			Components and Equipment	2.1														
			Test Procedures	2.11.1														
			Diagrams	3.1														
			Manufacturer's Experience	2.1														
			Performance Tests	3.6														
			Field Training	3.8														
			SD-06 Test Reports															
			Performance Tests	3.6														
			Testing, Adjusting, and Balancing	3.5														
			SD-07 Certificates															
			Bolts															
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.8														
			Instructions															
		15910	SD-01 Preconstruction Submittals															
			List of Drawings		G													
			List of Symbols and Abbreviations		G													
			Used on Drawings															
			List of I/O Points		G													
			Equipment Components List		G													
			AC Power Table		G													
			SD-02 Shop Drawings															

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		15910	Control System Schematic	1.4.1.1														
			Terminal Strip															
			Wiring Diagrams															
			Ladder Diagrams	1.4.1.2														
			Communication Network		G													
			Architecture and Block Diagram															
			SD-03 Product Data															
			DDC hardware		G													
			DDC capabilities		G													
			VARIABLE FREQUENCY 3	2.7	G													
			PHASE MOTOR DRIVES															
			Workstation software		G													
			Input devices		G													
			Output devices		G													
			Surge and Transient Protection		G													
			Notebook computer	2.1.5.1	G													
			Smoke detectors	2.5.1	G													
			SD-06 Test Reports															
			Field Tests	3.3.3	G													
			Commissioning Report															
			Performance Verification Tests	3.3.4	G													
			Training	3.4														
			SD-07 Certificates															
			Contractors Qualifications	1.7.5	G													
			Training	3.4	G													

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		15910	SD-10 Operation and Maintenance															
			Data															
			Controls and HVAC System		G													
			Operators Manual															
			DDC Manufacturer's Hardware		G													
			and Software Manuals															
			SD-11 Closeout Submittals															
			Training Course Documentation	1.7.6	G													
			Service organizations	1.7.7	G													
			Contractor certification	1.7.8	G													
		15990	SD-02 Shop Drawings															
			TAB Schematic Drawings and	3.3	G													
			Report Forms															
			SD-03 Product Data															
			TAB Related HVAC Submittals	3.2														
			TAB Procedures	3.4.1	G													
			Calibration	1.4														
			Systems Readiness Check	3.4.2														
			TAB Execution	3.4.1	G													
			TAB Verification	3.4.4	G													
			SD-06 Test Reports															
			Design Review Report	3.1	G													
			Systems Readiness Check	3.4.2	G													
			TAB Report	3.4.3	G													
			TAB Verification Report	3.4.4	G													
			SD-07 Certificates															

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		15990	TAB Firm	1.5.1	G													
			TAB Specialist	1.5.2	G													
		15995	SD-03 Product Data															
			Commissioning Team	3.1	G													
			Tests	1.3.1.7	G													
			Tests	3.2	G													
			Pre-Commissioning Checks	3.2.1	G													
			Owner's Project Requirements	1.3.1.1	G													
			Commissioning Plan	1.3.1.3	G													
			Training Verification	1.3.1.8	G													
			Commissioning Report	1.3.1.10	G													
			SD-06 Test Reports															
			Test Reports	3.2	G													
			SD-07 Certificates															
			Qualifications		G													
			SD-10 Operation and Maintenance															
			Data															
			Re-commissioning Manual		G													
		16070	SD-02 Shop Drawings															
			Lighting Fixtures in Buildings	3.2	G													
			Equipment Requirements	1.4	G													
			SD-03 Product Data															
			Lighting Fixtures in Buildings	3.2	G													
			Equipment Requirements	1.4	G													
			Contractor Designed Bracing	1.3.3	G													
		16375	SD-02 Shop Drawings															

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		16375	Electrical Distribution System	3.11.3	G													
			Profile Drawings		G													
			As-Built Drawings		G													
			SD-03 Product Data															
			Nameplates	2.2														
			Material and Equipment	2.1														
			General Installation	3.1														
			Requirements															
			SD-06 Test Reports															
			Factory Tests	2.16														
			Field Testing	3.11														
			Operating Tests	3.11.8														
			Cable Installation	3.2.1.4														
			SD-07 Certificates															
			Material and Equipment	2.1														
			Cable Joints	3.3	G													
			Cable Installer Qualifications		G													
			SD-10 Operation and Maintenance															
			Data															
			Electrical Distribution System	3.11.3	G													
		16415	SD-02 Shop Drawings															
			Interior Electrical Equipment		G													
			SD-03 Product Data															
			Manufacturer's Catalog															
			Material, Equipment, and Fixture															
			Lists															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
FY05 Chapel Complex, Fort Lewis, WA

CONTRACTOR

ACTIVITY NO (a)	TRANSMITTAL NO (b)	SPEC SECT (c)	DESCRIPTION ITEM SUBMITTED (d)	PARAGRAPH # (e)	CLASSIFICATION (f)	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIAL NEEDED BY (i)	CONTRACTOR ACTION CODE (j)	DATE OF ACTION (k)	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR (l)	APPROVING AUTHORITY DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	ACTION CODE (o)	DATE OF ACTION (p)	MAILED TO CONTR/ DATE RCD FRM APPR AUTH (q)	REMARKS (r)
		16415	Installation Procedures															
			As-Built Drawings	1.2.6	G													
			Onsite Tests		G													
			SD-06 Test Reports															
			Factory Test Reports		G													
			Field Test Plan		G													
			Field Test Reports	3.19	G													
			SD-07 Certificates															
			Materials and Equipment	1.4														
		16420	SD-02 Shop Drawings															
			Detail Drawings		G													
			SD-03 Product Data															
			Manufacturer's Catalog															
			Material, Equipment, and Fixture Lists															
			Installation Procedures															
			As-Built Drawings		G													
			Onsite Tests		G													
			SD-06 Test Reports															
			Field Test Plan		G													
			Field Test Reports		G													
			SD-07 Certificates															
			Materials and Equipment	1.4														
		16475	SD-03 Product Data															
			Fault Current Analysis	2.2	G													

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		16475	Protective Device Coordination	2.2	G													
			Study															
			Arc-Flash Hazard Analysis															
			Equipment	2.1														
			System Coordinator	1.4.1	G													
			Protective Relays															
			Installation	3.2														
			SD-06 Test Reports															
			Field Testing	3.3	G													
			SD-07 Certificates															
			Devices and Equipment	1.6	G													
		16528	SD-02 Shop Drawings															
			Lighting System	1.3.1	G													
			Detail Drawings	2.9.1	G													
			As-Built Drawings	3.12.2														
			SD-03 Product Data															
			Equipment and Materials															
			Spare Parts															
			SD-06 Test Reports															
			Operating Test	3.12.1	G													
			Ground Resistance	3.12.2														
			Measurements															
			SD-10 Operation and Maintenance															
			Data															
			Lighting System	1.3.1														
		16710	SD-02 Shop Drawings															

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		16710	Premises Distribution System	1.7	G													
			Installation	3.1	G													
			SD-03 Product Data															
			Record Keeping and	1.8	G													
			Documentation															
			Spare Parts	3.1.9														
			Manufacturer's	3.1.2	G													
			Recommendations															
			Test Plan	3.6	G													
			Qualifications	1.5	G													
			SD-06 Test Reports															
			Test Reports	3.6														
			SD-07 Certificates															
			Premises Distribution System	1.7														
			Materials and Equipment	2.1														
			Installers	1.5.1	G													
		16711	SD-02 Shop Drawings															
			Telephone System		G													
			Installation	3.1	G													
			Record Drawings		G													
			SD-03 Product Data															
			Spare Parts															
			Equipment	1.5.2														
			Installation	3.1	G													
			Acceptance Tests	3.5	G													
			Cutover and Records	3.4	G													

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		16711	SD-06 Test Reports															
			Acceptance Tests	3.5														
			SD-07 Certificates															
			Telephone System															
			Qualifications	1.4	G													
		16770	SD-02 Shop Drawings															
			Detail Drawings	1.3.3	G													
			SD-03 Product Data															
			Spare Parts	1.3.4														
			SD-06 Test Reports															
			Approved Test Procedures	3.3	G													
			Acceptance Tests	3.3														
			SD-07 Certificates															
			Components	2.1														
			SD-10 Operation and Maintenance															
			Data															
			Radio and Public Address	1.3														
			System															
		16772	SD-02 Shop Drawings															
			Mass Notification System	1.3.6	G													
			Spare Parts	2.8.3														
			Storage Batteries	2.2.2.1														
			Voltage Drop															
			Special Tools and Spare Parts															
			Technical Data and Computer		G													
			Software															

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		16772	Training	3.4														
			Testing	3.3	G													
			SD-06 Test Reports															
			Test Procedures		G													
			Acceptance Tests	3.3	G													
			SD-07 Certificates															
			Equipment															
			Qualifications		G													
			SD-10 Operation and Maintenance															
			Data															
			Technical Data and Computer		G													
			Software															
		16777	SD-02 Shop Drawings															
			Detail Drawings		G													
			SD-03 Product Data															
			Spare Parts															
			Manufacturer's Catalog															
			Material, Equipment, and Fixture															
			Lists															
			Installation Procedures															
			SD-06 Test Reports															
			Field Test Plan		G	G												
			SD-07 Certificates															
			Components															
			SD-10 Operation and Maintenance															
			Data															

SUBMITTAL REGISTER

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FY05 Chapel Complex, Fort Lewis, WA

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		16777	Audio System															
		16844	SD-03 Product Data															
			Electronic Carillon		G													
			SD-10 Operation and Maintenance															
			Data															
			Electronic Carillon, Data Package		G													
			1															

SECTION 01335

SUSTAINABLE DESIGN AND CONSTRUCTION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

The facilities in this project shall be constructed to provide a minimum LEED rating of "Gold" in accordance with the Leadership in Energy and Environmental Design (LEED)Green Building Rating System (LEED-NC GBRS). The "as-designed" projected LEED Checklist points total for this project exceeds the threshold for "Gold". However, many of the identified points must be attained through the actions of the contractor during and immediately following the construction period.

LEED performance related requirements are indicated on the drawings and contained in many specification sections. While this section summarizes general sustainable design requirements and documentation and submittal procedures, the Contractor shall also review each specification section to identify and verify those mandatory and optional sustainable design activities, materials, products and/or systems which are required.

The contractor shall provide a "LEED Accredited Professional" (AP) to organize, coordinate, direct and document the sustainable design actions associated with this project. The AP may be directly employed by the contactor or a subcontracted consultant. The AP shall be associated with the project from contract award to final submittal and acceptance of documentation.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U. S. GREEN BUILDING COUNCIL (USGBC)

LEED-NC CL	(2003) LEED (Leadership in Energy and Environmental Design), Project Checklist (Version 2.1)
LEED-NC GBRS	(2002)(Rev 3/2003) LEED (Leadership in Energy and Environmental Design), Green Building Rating System For New Construction & Major Renovations (Version 2.1)
LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 GENERAL REQUIREMENTS

1.3.1 Minimum LEED Rating

This project shall be constructed to attain a LEED-NC GBRS score (minimum of 39 points) high enough to provide at least a "Gold" rating. However, it is the desire of the Government to obtain the highest possible LEED point score within the restrictions of the design, installation standards and the project's budgetary constraints. The Contractor shall provide additional design services and documentary compilations during construction as required by drawings and specifications and as otherwise necessary to satisfy the requirements for the minimum "Gold" rating. The contractor shall become familiar with all requirements and parameters such that no actions contrary to, or inconsistent with, the sustainable design intent of this project are taken during construction.

1.3.2 Documentation Notebook

Prior to final inspection, the Contractor shall provide a stand alone Documentation Notebook for this facility verifying compliance with LEED-NC GBRS, and other requirements as listed in this specification section and as otherwise identified within the Project Manual. This documentation shall utilize standard USGBC Letter Templates and worksheets, and be complete, formatted as required, and ready for submittal to USGBC for LEED certification review. <u>However, the Contractor shall not initiate or perform formal USGBC project registration or certification submittal activities, and shall not include costs for these activities under this contract.</u> A copy of the LEED Project Checklist (LEED-NC CL) shall be included to provide a summary of the current credit status. Contractor shall review the LEED Reference Guide LEED-NC RG to ensure conformance with documentation requirements and suggested strategies to use in maximizing point totals and rating.Documentation shall be provided for all credits, including those where Government participation may be required.

1.3.3 Documentation Maintenance

Compilation of the Documentation Notebook shall be started at contract award, kept current on a weekly basis and be available on the jobsite at all times. Failure to maintain Documentation Notebooks in a current state on a weekly basis, and furnish approved, bound manuals in the required quantity by the final inspection, may delay the final inspection and will be cause for the Contracting Officer to hold or adjust the retained percentage in accordance with CONTRACT CLAUSE, PAYMENTS UNDER FIXED PRICE CONSTRUCTION CONTRACTS.

1.3.4 Coordination with the Government

Some LEED credits are based on planning or operational procedures of the installation,(such as site selection)and are not design or construction influenced. For these credit instances the Contractor shall coordinate with the Government to identify actions that must occur during construction and verify if specific credits can be counted. The Contractor shall not assume that any Government action will occur, or that additional Government expenditure will be made to acquire credits. All credits shall be documented by the Contractor, regardless of the responsible party (contractor, government or designer) for a particular credit.

1.3.5 Prerequisite Credits

All prerequisite LEED credits indicated by the LEED-NC GBRS shall be obtained and documented.

1.3.6 Required Credits

Some LEED credits involve material selection and are generally identified within the Technical Specifications. Other LEED credits are dependent on construction practices, procurement data or cumulative calculations of components of materials throughout the project. Throughout the Project Manual required performance standards are identified. Part 3 of this specification and Table 01335 identify the LEED credit items that are designed into or are otherwise required for this project. No variations or substitutions to the LEED credits identified for this contract shall be allowed without written approval from the Contracting Officer. If the Contractor identifies a problem or conflict in meeting the full requirements of a LEED credit identified for this project, the Contractor shall immediately notify the Contracting Officer.

1.3.7 Documentation Compliance Plan

Within 45 days following contract award, the contractor shall submit a Compliance Plan. Provide a written plan describing the general compliance processes to be followed for creating required LEED documentation during construction, assuring that all LEED related concepts and requirements are integrated during construction, communicating project status to the Government and subcontractors and preparing documentation for submittal to the Government. This plan shall identify all construction practices, procurement data and cumulative calculations of components required for LEED credit that must be identified and tracked during the course of construction. Plan shall indicate each of the specific LEED credits being tracked or documented, individual components of the LEED credit related items, projected and actual dates of submittal of individual components of the LEED credit related items, and the proposed method of tracking in accordance with the LEED Reference Guide and Rating System.

1.3.8 Progress Reports

Compliance Plan shall be updated to reflect progress, tabulate current estimated credit points total, and identify specific actions taken and/or tasks completed, and submitted as a progress report with each application for payment. Plan shall also be updated and resubmitted at three month intervals as part of the Documentation Notebook. Failure to update the Compliance Plan and submit with payment requests will be cause for the Contracting Officer to hold or adjust the retained percentage in accordance with CONTRACT CLAUSE, PAYMENTS UNDER FIXED PRICE CONSTRUCTION CONTRACTS.

1.4 PAYMENT

No separate payment will be made for work covered under this section. All costs associated with this section shall be included in the contract price. The Contractor is not responsible for payment of any registration, review

or certification fees to the U.S. Green Building Council.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Detailed documentation on submittal requirements is contained in various Technical Specifications and outlined in the paragraphs below. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

LEED Accredited Professional; G

Provide the name of the LEED Accredited Professional who shall provide coordination of all sustainable design and construction activities for the Contractor. LEED AP shall be on site for at least 4 hours per week. Provide a copy of the LEED Accredited Professional Certificate for this person.

List of Proposed Products for Attainment of LEED Credits; G

Provide a list of materials and products identified for use in this project to satisfy LEED credit requirements. Materials and products shall be listed with manufacturer contact information and associated with their pertinent LEED categories and credit(s). Materials and products shall have recycled content (post-consumer and/or post-industrial), manufacturing plant location and recyclable content listed.

LEED Documentation Compliance Plan; G

Provide a written Compliance Plan to be followed for creating required LEED documentation and assuring compliance with sustainable design requirements throughout the construction period. Plan shall be updated and resubmitted with each payment request and at three month intervals with Documentation Notebook.

Miscellaneous Plans; G

Prepare and provide the following miscellaneous plans with content and format as required by USGBC:

Soil and Erosion Control Plan
Construction Waste Management Plan
Indoor Air Quality Plan

<u>THE FOLLOWING SUBMITTAL REQUIREMENTS APPLY TO ALL SPECIFICATION SECTIONS</u>:

SD-02 Shop Drawings

Materials, Products and Processes; G

Drawings, diagrams and schedules submitted as required by any specification section shall indicate LEED related aspects where applicable to the materials, products or construction processes involved. Indicate intermediate work processes required for LEED compliance. Show how multiple systems and interdisciplinary work shall be coordinated.

SD-03 Product Data

Products Used to Attain LEED Credits; G

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures provided to satisfy requirements of any specification section shall highlight information pertinent to LEED credits.

SD-05 Design Data

Documentation Notebook; G
Design Data; G
LEED Templates and Calculators; G

Provide calculations, mix designs, analyses or other data pertaining to a part of work as it relates to attainment of LEED credits. Furnish draft and final copies of LEED related templates and calculators required to document design and construction activities and completed systems. All materials shall be provided in a unified submittal with the Documentation Notebook.

SD-06 Test Reports

Laboratory Testing; G

Provide copies of reports signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested to demonstrate compliance with specified LEED requirements.

Job Site Tests and Samples; G

Provide copies of test results required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site to demonstrate compliance with LEED requirements.

Commissioning, Acceptance and Operational Tests; G

Provide copies of reports which include findings of tests and observations made at the job site, or on samples taken from the job site, on portions of work during or after installation, that document compliance with LEED requirements.

SD-07 Certificates

Manufacturer Certification; G

Provide statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets requirements for LEED credit criteria. Statements shall be dated after award of project contract and clearly name the project.

Designer Certification; G

Statements signed by designers (for design actions performed by the contractor during construction), including copies of LEED templates, attesting that product, system or material meets requirements for LEED credit criteria. Must be dated after award of project contract and clearly name the project.

SD-10 Operation and Maintenance Data; G

Operation and maintenance data that is required to document conformance with criteria for LEED credits

SD-11 Closeout Submittals; G

Complete paper and electronic copies of all documentation required by the USGBC for LEED certification submittal. Documentation shall be organized, formatted and ready for submittal to USGBC. The Contractor shall prepare a comprehensive Documentation Notebook indicating how each LEED credit was achieved. Notebook shall contain all required data to support full compliance with the indicated LEED credits. Documentation Notebook shall be formatted to match LEED numbering system and tabbed for each point.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance with the contract requirements for specific sustainable design requirements and attainment of overall LEED scores for each building type. Any work, including all LEED related documentation, found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections or tests.

1.7 Materials Furnished by Government

The Government will provide the contractor with an electronic file containing Letter Templates and Worksheets documenting design actions current to the end of design. The contractor shall be responsible for completing the construction related portions of the Letter Templates and Worksheets.

PART 2 PRODUCTS

2.1 Documentation Notebook

Closeout submittal by the contractor shall be complete and final copies of the sustainable design (LEED) Documentation Notebook. Complete paper and electronic copies of all documentation required by the USGBC for LEED certification submittal, including full discussion and support of all "Innovation in Design" credits attempted. Documentation shall be organized, formatted and ready for submittal to USGBC. The Contractor shall prepare a comprehensive Documentation Notebook indicating how each LEED credit was achieved. Notebook shall contain all required data to support full compliance with the indicated LEED credits. Documentation Notebook shall be formatted to match LEED numbering system and tabbed for each point.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that all planning documents, design activities, performance standards, construction methodology and job site practices are developed, implemented and maintained so as to satisfy all identified LEED credit requirements. Review the work of all subcontractors, and the products and processes of manufacturers and suppliers to verify targeted sustainable design performance and attainment of LEED credit objectives. Perform active, ongoing examination of LEED Documentation and work in place to identify and correct materials, processes, activities and/or documentation that do not conform to LEED credit requirements or other specified sustainable design practices.

3.2 PREPARATION

3.2.1 Work Area Limits

Prior to the beginning of any design or construction activity, the Contractor shall identify, through direction by the Government, land resources to be preserved within the work area. Mark the areas that need to be protected under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced.

3.2.2 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Collection points for separated construction waste materials shall be located conveniently to the work area and as approved by the Contracting Officer.

3.3 APPLICATION

LEED credits as identified below and summarized in Table 01335-1 shall be incorporated and documented as required by the drawings and specifications

and in full compliance with LEED Reference Guide and the Green Building Rating System. In addition to satisfying all LEED prerequisites, the LEED (version 2.1) credits identified below are mandatory for this project and shall be constructed and otherwise implemented consistent with LEED documentation and submittal requirements, and the specific application instructions listed below. All other LEED credits are optional in their selection and application.

3.3.1 SUSTAINABLE SITES

3.3.1.1 Prerequisite 1, Erosion and Sedimentation Control

The Contractor shall be responsible for preparing a sediment and erosion control plan that conforms with Federal, State, and local laws and regulations (including Fort Lewis installation requirements).

3.3.1.2 Credit 1, Site Selection

The development site identified by the Government for this project is compliant with LEED requirements. Comply with construction and submittal requirements for this credit.

3.3.1.3 Credit 2, Development Density

This credit is not attainable for this project.

3.3.1.4 Credit 3, Brownfield Redevelopment

This credit is not attainable for this project.

3.3.1.5 Credit 4.1, Alternative Transportation, Public Transportation Access

This credit is not attainable for this project.

3.3.1.6 Credit 4.2, Alternative Transportation, Bicycle Storage and Changing Rooms

Comply with construction and submittal requirements for this credit.

3.3.1.7 Credit 4.3, Alternative Transportation, Alternative Fuel Vehicles

Comply with construction and submittal requirements for this credit.

3.3.1.8 Credit 4.4, Alternative Transportation, Parking Capacity and Carpooling

Comply with construction and submittal requirements for this credit.

3.3.1.9 Credit 5.1, Reduced Site Disturbance, Protect or Restore Open Space

Comply with construction and submittal requirements for this credit. Use criteria for "previously developed" sites.

3.3.1.10 Credit 5.2, Reduced Site Disturbance, Development Footprint.

Comply with construction and submittal requirements for this credit. "Local zoning" requirements do not apply.

3.3.1.11 Credit 6.1, Stormwater Management, Rate and Quantity

Comply with construction and submittal requirements for this credit.

3.3.1.12 Credit 6.2, Stormwater Management, Treatment

Comply with construction and submittal requirements for this credit.

3.3.1.13 Credit 7.1, Landscape & Exterior Design to Reduce Heat Islands, Non-Roof

Comply with construction and submittal requirements for this credit.

3.3.1.14 Credit 7.2, Landscape & Exterior Design to Reduce Heat Islands, Roof

Comply with construction and submittal requirements for this credit.

3.3.1.15 Credit 8, Light Pollution Reduction

Comply with construction and submittal requirements for this credit.

3.3.2 WATER EFFICIENCY

3.3.2.1 Credit 1.1, Water Efficient Landscaping, Reduce by 50%

Comply with construction and submittal requirements for this credit.

3.3.2.2 Credit 1.2, Water Efficient Landscaping, No Potable Use or No Irrigation

Comply with construction and submittal requirements for this credit.

3.3.2.3 Credit 2, Innovative Wastewater Technologies

Comply with construction and submittal requirements for this credit.

3.3.2.4 Credit 3.1, Water Use Reduction, 20% Reduction

Comply with construction and submittal requirements for this credit.

3.3.2.5 Credit 3.2, Water Use Reduction, 30% Reduction

Comply with construction and submittal requirements for this credit.

3.3.3 ENERGY AND ATMOSPHERE

3.3.3.1 Prerequisite 1, Fundamental Building Systems Commissioning

Comply with construction and submittal requirements for this prerequisite.

Individual component commissioning requirements are specified in the Technical Specifications. The contractor shall group all reports and results of commissioning into this requirement for Building Systems Commissioning.

3.3.3.2 Prerequisite 2, Minimum Energy Performance

Comply with construction and submittal requirements for this prerequisite.

3.3.3.3 Prerequisite 3, CFC Reduction in HVAC&R Equipment

Comply with construction and submittal requirements for this prerequisite.

3.3.3.4 Credit 1, Optimize Energy Performance

Comply with construction and submittal requirements for this credit.

3.3.3.5 Credits 2.1-2.3, Renewable Energy

These credits are not attainable for this project.

3.3.3.6 Credit 3, Additional Commissioning

This credit is not attainable for this project.

3.3.3.7 Credit 4, Ozone Depletion

Comply with construction and submittal requirements for this credit.

3.3.3.8 Credit 5, Measurement and Verification

This credit is not attainable for this project.

3.3.3.9 Credit 6, Green Power

Confirm that Government contract for Green Power remains in effect and that it provides sufficient power to meet credit requirements. Comply with construction and submittal requirements for this credit.

3.3.4 MATERIALS AND RESOURCES

3.3.4.1 Prerequisite 1, Storage and Collection of Recyclables

Comply with construction and submittal requirements for this prerequisite. Coordinate with Government for current installation recycling program requirements.

3.3.4.2 Credits 1.1 - 1.3, Building Reuse

These credits are not attainable for this project.

3.3.4.3 Credit 2.1, Construction Waste Management, Divert 50%

Comply with construction and submittal requirements for this credit. In

addition to the requirements of SECTION 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, the contractor shall include in the LEED Compliance Plan a waste management plan that complies with the requirements for recycling and/or salvage of at least 50% of construction, demolition and land clearing waste. The plan should include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value.

3.3.4.4 Credit 2.2, Construction Waste Management, Divert 75%

Comply with construction and submittal requirements for this credit. Requirements as indicated in 3.3.4.3, plus the recycling and/or salvage of at least an additional 25% (minimum 75% total) of construction, demolition and land clearing waste to gain the point for this credit.

3.3.4.5 Credit 3.1 and 3.2, Resource Reuse

These credits are not attainable for this project.

3.3.4.6 Credit 4.1, Recycled Content, Specify 5%

Comply with construction and submittal requirements for this credit. In addition to the requirements of Section 01670 RECYCLED/RECOVERED MATERIALS promoting the use of recycled or recovered materials, the contractor shall included in the LEED Compliance Plan a method of tracking, record keeping and validation that a minimum of 5% of the total value of building materials used contain recycled content material as defined and allowed by the LEED criteria. The plan shall include proposed worksheets for tracking the materials and values used and record keeping requirements for documentation to validate details required for submittal. Documentation for all recycled materials shall indicate location of manufacturing plant, specific content characteristics and the amount of "Rapidly Renewable Materials" contained in the materials and products used.

3.3.4.7 Credit 4.2, Recycled Content, Specify 10%

Comply with construction and submittal requirements for this credit. Requirements as indicated in 3.3.4.6, plus the use of an additional 5% (minimum 10% total) of the total value of building materials used contain recycled content material as defined and allowed by the LEED criteria.

3.3.4.8 Credit 5.1, Local/Regional Materials, 20% Manufactured Locally

Comply with construction and submittal requirements for this credit. The contractor shall include in the LEED Compliance Plan a method of tracking, record keeping and validation that a minimum of 20% of building products are manufactured regionally within a radius of 500 miles. Provide manufacturer's records of the plant location(s) from which products were shipped. The plan shall include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value.

3.3.4.9 Credit 5.2, Local/Regional Materials, of 20% Manufactured Locally, 50% Harvested Locally

Comply with construction and submittal requirements for this credit. The contractor shall include in the LEED Compliance Plan a method of tracking, record keeping and validation that a minimum of 50% of building products are harvested regionally within a radius of 500 miles. The plan shall include proposed worksheets for tracking the value used and record keeping requirements for documentation to validate the final value.

3.3.4.10 Credit 6, Rapidly Renewable Materials

This credit is not attainable for this project.

3.3.4.11 Credit 7, Certified Wood

Attainment of this credit is optional. If pursued, comply with construction and submittal requirements for this credit. The contractor shall include in the LEED Compliance Plan a method of tracking, record keeping and validation that a minimum of 50% of wood-based materials are certified in accordance with the Forest Stewardship Council guidelines for wood building components, including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

3.3.5 INDOOR ENVIRONMENTAL QUALITY

3.3.5.1 Prerequisite 1, Minimum IAQ Performance

Comply with construction and submittal requirements for this prerequisite.

3.3.5.2 Prerequisite 2, Environmental Tobacco Smoke (ETS) Control

Comply with construction and submittal requirements for this prerequisite. Smoking is prohibited in this facility.

3.3.5.3 Credit 1, Carbon Dioxide (CO_2) Monitoring

Comply with construction and submittal requirements for this credit.

3.3.5.4 Credit 2, Ventilation Effectiveness

Comply with construction and submittal requirements for this credit.

3.3.5.5 Credit 3.1, Construction IAQ Management Plan, During Construction

Comply with construction and submittal requirements for this credit. The contractor shall include in the LEED Compliance Plan a Construction Indoor Air Quality (IAQ) Management Plan for the construction phase of the building that, during construction, meets or exceeds the minimum LEED requirements for this credit.

3.3.5.6 Credit 3.2, Construction IAQ Management Plan, Before Occupancy

Comply with construction and submittal requirements for this credit. The contractor shall include in the LEED Compliance Plan a Construction Indoor

Air Quality (IAQ) Management Plan for the pre-occupancy phase of the building that meets or exceeds the minimum LEED requirements for this credit.

3.3.5.7 Credit 4.1, Low Emitting Materials, Adhesives and Sealants

Comply with construction and submittal requirements for this credit. Submittals for adhesives and sealants shall indicate VOC characteristics. In particular, review the requirements of sections 07840 and 07920.

3.3.5.8 Credit 4.2, Low Emitting Materials, Paints

Comply with construction and submittal requirements for this credit. Submittals for paints shall indicate VOC characteristics. In particular, review the requirements of section 09900.

3.3.5.9 Credit 4.3, Low Emitting Materials, Carpet

Comply with construction and submittal requirements for this credit. Submittals for carpets shall indicate VOC characteristics. In particular, review the requirements of section 09685.

3.3.5.10 Credit 4.4, Low Emitting Materials, Composite Wood & Agrifiber

Comply with construction and submittal requirements for this credit. Submittals for composite wood and agrifiber shall indicate VOC characteristics. In particular, review the requirements of sections 06200 and 06415.

3.3.5.11 Credit 5.0, Indoor Chemical and Pollutant Source Control

Comply with construction and submittal requirements for this credit.

3.3.5.12 Credit 6.1, Controllability of Systems, Perimeter

Comply with construction and submittal requirements for this credit.

3.3.5.13 Credit 6.2, Controllability of Systems, Non-Perimeter

This credit is not available for this project.

3.3.5.14 Credit 7.1, Thermal Comfort, Comply with ASHRAE 55-1992

Comply with construction and submittal requirements for this credit.

3.3.5.15 Credit 7.2, Thermal Comfort, Permanent Monitoring System

This credit is not available for this project.

3.3.5.16 Credit 8.1, Daylight & Views, Daylight 75% of Spaces

This credit is not available for this project.

3.3.5.17 Credit 8.2, Daylight & Views, Views for 90% of Spaces

This credit is not available for this project.

3.3.6 INNOVATION AND DESIGN PROCESS

3.3.6.1 Innovation in Design

The Contractor shall implement exceptional performance and innovative design/construction practices identified herein. The Contractor is also encouraged to seek out additional opportunities for innovation in construction practices. Identified potential innovation credits include:

1. 100% of Building powered from Green Power
2. Topsoil depth and quality, Best Management Practices

3. Educational signage throughout the building.
4. Divert +95% of Construction Waste.

3.3.6.2 LEED Accredited Professional

Comply with construction and submittal requirements for this credit. Provide an accredited professional responsible for coordination of all LEED related performance and documentation requirements under this contract.

TABLE 01335
LEED SUMMARY TABLE

LEED Credit Reference	LEED CATEGORIES	Anticipated points (at Final Design)	Program/Design - Note 1	Material /System/Product - Note 2	Construction /Calcs/Plans- Note 3	Specification or Drawing References and Comments
	SUSTAINABLE SITES					
Pre-1	Sediment/Erosion Control Plan	0			P	01410, 01501, 02230, 02300
1.0	Site Selection	1	R			
2.0	Development Density	0				Not Attainable for this project.
3.0	Brownfield Redevelopment	0			?	
4.1	Alternative Transportation: Public Transportation Access	0				Not Attainable for this project.
4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1	R			02870
4.3	Alternative Transportation: Alternative Fuel Vehicles	0			?	Subject to development of alt. fuel facility (N.I.C.) by Government
4.4	Alternative Transporation: Parking Capacity	1	R			10430
5.1	Reduced Site Disturbance: Protect or Restore Open Space	1	R		R	
5.2	Reduced Site Disturbance: Development Footprint	1	R			
6.1	Stormwater Management: Rate and Quantity	1	R			02620, 02630
6.2	Stormwater Management: Treatment	1	R	R		02620, 02630
7.1	Heat Island Effect: Non-Roof	1				
7.2	Heat Island Effect: Roof	1	R			Possible with metal roofed bldgs
8.0	Light Pollution Reduction	1	R			16415, 16528
	WATER EFFICIENCY					
1.1	Water Efficient Landscaping: Reduce by 50%	1	R	R		02811
1.2	Water Efficient Landscaping: No Potable Use or No Irrigation	1	R	R		02811
2.0	Innovative Wastewater Technologies	0				
3.1	Water Use Reduction: 20% Reduction	1	R			15400
3.2	Water Use Reduction: 30% Reduction	1	R			15400

TABLE 01335
LEED SUMMARY TABLE

	ENERGY & ATMOSPHERE					
Pre-1	Fundamental Building Systems Commissioning	0	P	P	P	15990, 15995 and Divisions 15 & 16 generally.
Pre-2	Minimum Energy Performance	0	P			
Pre-3	CFC Reduction in HVAC&R Equipment	0	P	P		15895
1.0	Optimize energy performance (up to 10 points possible)	4	R	R	R	15895
2.1	Renewable Energy: 5%	1	R	R		15741
2.2	Renewable Energy: 10%	1	R	R		15741
2.3	Renewable Energy: 20%	1	R	R		15741
3.0	Additional Commissioning	0	?			
4.0	Ozone Protection	1	R			15895
5.0	Measurement and Verification	?	R			15895, 15910, 15990, 15995, and Division 16 generally.
6.0	Green power	1	R		?	Verify Government power contract
	MATERIALS & RESOURCES					
Pre-1	Storage & Collection of Recyclables	0	P			
1.1	Building Reuse: Maintain 75% of Existing Walls, Floors and Roof	0				Not Attainable for this project.
1.2	Building Reuse: Maintain 100% of Existing Walls, Floors and Roof	0				Not Attainable for this project.
1.3	Building Reuse: Maintain 100% of Shell/Structure and 50% of Non-Shell/Non-Structure	0				Not Attainable for this project.
2.1	Construction Waste Management: Divert 50% from Landfill	1			R	01572
2.2	Construction Waste Management: Divert 75% from Landfill	1			R	01572
3.1	Resource Reuse: 5%	0				Not Attainable for this project.
3.2	Resource Reuse: 10%	0				Not Attainable for this project.
4.1	Recycled Content: 5% (post consumer + 1 /2 post-industrial)	1	R	R	R	01670, 02220, 02722, 02870, 03200, 03300, 03330, 04220, 05120, 05210, 05300, 05400, 07210, 07220, 08110, 08120, 08520, 09250, 09310, 09510, 09685, 10160
4.2	Recycled Content: 10% (post consumer + 1 /2 post-indust.)	1	R	R	R	Same as credit 4.1.
5.1	Regional Materials: 20% Manufactured Regionally	1		R	R	
5.2	Regional Materials: 50% Extracted Regionally	1		R	R	
6.0	Rapidly Renewable Materials	0				
7.0	Certified Wood	1	R	R	R	03100, 06100, 06200, 06410, 06415, 08210

TABLE 01335
LEED SUMMARY TABLE

	INDOOR ENVIRONMENTAL QUALITY					
Pre-1	Minimum IAQ Performance	0	P		P	
Pre-2	Environmental Tobacco Smoke (ETS) Control	0	P		P	
1.0	Carbon Dioxide (CO_2) Monitoring	1	R	R		
2.0	Ventilation Effectiveness	?	R			15895
3.1	Construction IAQ Management Plan: During Construction	1			R	
3.2	Construction IAQ Management Plan: Before Occupancy	1			R	
4.1	Low-Emitting Materials: Adhesives and Sealants	1	R	R	R	07900
4.2	Low-Emitting Materials: Paints and Coatings	1	R	R	R	06410, 06415, 09900
4.3	Low-Emitting Materials: Carpet	1	R	R	R	09685
4.4	Low-Emitting Materials: Composite Wood	1	R	R	R	06100, 06200, 06410, 06415
5.0	Indoor Chemical & Pollutant Source Control	1	R			05500, 10990
6.1	Controllability of Systems: Perimeter Spaces	1	R			
6.2	Controllability of Systems: Non-Perimeter Spaces	0				Not Attainable for this project.
7.1	Thermal Comfort: Compliance with ASHRAE 55-1992	1	R			
7.2	Thermal Comfort: Permanent Monitoring System	?				
8.1	Daylight and Views: Daylight 75% of Spaces	?	R			08810
8.2	Daylight and Views: Views for 90% of Spaces	?	R			
	INNOVATION & DESIGN PROCESS					
1.0	Innovation in Design	4				
2.0	LEED Accredited Professional	1	R			
	TOTAL POINTS (69 POSSIBLE) LEED CATEGORIES/POINTS Certified: 26-32 points Silver: 33-38 points Gold: 39-51 points Platinum: 52-69 points	? ?				

TABLE 01335
LEED SUMMARY TABLE

NOTES:

1. POINTS INDICATED IN THIS COLUMN ARE DETERMINED BY PROGRAMMATIC AND/OR DESIGN REQUIREMENTS.

2. POINTS INDICATED IN THIS COLUMN ARE DEPENDENT ON MATERIAL OR SYSTEM SELECTION OR PRODUCT PROPERTIES.

3. POINTS INDICATED IN THIS COLUMN ARE DEPENDENT ON CONSTRUCTION PRACTICES, PROCUREMENT DATA OR CUMULATIVE CALCULATIONS OF MATERIALS THROUGHOUT THE PROJECT.

4. SEE LEED REFERENCE GUIDE GREEN BUILDING RATING SYSTEM FOR FULL DESCRIPTION OF REQUIREMENTS FOR EACH ITEM.

5. COLUMNS MARKED WITH AN "R" INDICATE A REQUIRED LEED CREDIT THAT SHALL BE DESIGNED AND/OR CONSTRUCTED AND DOCUMENTED BY THE CONTRACTOR.

6. COLUMNS MARKED WITH A “P” INDICATE A PREREQUISITE REQUIREMENT FOR LEED CREDIT THAT SHALL BE DESIGNED AND/OR CONSTRUCTED AND DOCUMENTED BY THE CONTRACTOR.

7. COLUMNS MARKED WITH A “?” INDICATE A POSSIBLE LEED CREDIT THAT SHALL BE EVALUATED AND DOCUMENTED DURING CONSTRUCTION.

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SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

33 CFR 328	Definitions of Waters of the United States
40 CFR 152 - 186	Pesticide Programs
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions
49 CFR 171 - 178	Hazardous Materials Regulations

U.S. ARMY (DA)

AR 200-5	(1999) Pest Management

U.S. ARMY, FORT LEWIS (DA)

FL 200-1	Environmental Protection and Enhancement

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety and Health Requirements Manual

WETLAND MANUAL Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

COUNCIL OF TREE AND LANDSCAPE APPRAISERS

Guide for Establishing Values of Trees and Other Plants, 2004

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners,excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.5 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.6 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.7 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.8 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers,creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

1.2.9 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.10 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

1.2.11 Hazardous Material (HM)

A useful product that requires special management because it has hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) that could pose dangers to human health or the environment. A HM becomes a Hazardous Waste when it can no longer be used for its intended purpose.

1.2.12 Hazardous Waste (HW)

A discarded material with properties that could pose dangers to human health or the environment. A HW either exhibits a hazardous characteristic or is specifically listed as a HW by the EPA or by the State.

1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may

occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, land, and includes management of visual esthetics, noise, solid waste, and erosion from stormwater, as well as pollutants.

1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

1.5 ABBREVIATIONS AND ACRONYMS

BACT	Best Available Control Technology
BMP	Best Management Practice
CFR	Code of Federal Regulations
CO	Contracting Officer
COR	Contracting Officer's Representative
DOT	Department of Transportation
ECMD	Engineering & Contract Management Division
ECO	Environmental Compliance Officer
ENRD	Environmental and Natural Resources Division
EPA	Environmental Protection Agency
HM	Hazardous Material
HW	Hazardous Waste
HMTA	Hazardous Materials Transportation Act
HW	Hazardous Waste
HWT	Hazardous Waste Technician
HWMS	Hazardous Waste Management Section

ISCP	Installation Spill Contingency Plan
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NPDES	National Pollution Discharge Elimination System
NOI	Notice of Intent
OSHA	Occupational Safety and Health Administration
PCS	Petroleum Contaminated Soil
PPE	Personal Protective Equipment
PW	Public Works
PSCAA	Puget Sound Clean Air Agency
RUL	Restricted Use List
TPCHD	Tacoma Pierce County Health Department
WAC	Washington Administrative Code
WHPA	Well Head Protection Area
WISHA	Washington Industrial Safety and Health Act

1.6 LAWS AND REGULATIONS

The Contractor shall comply with all applicable Federal, State, and Local environmental, natural and cultural resources, and historic preservation laws and regulations. Specific attention is directed to Fort Lewis Regulations No. 200-1 "Environmental Protection and Enhancement". These specifications supplement these laws and regulations.

1.7 COORDINATION

The Environmental and Natural Resources Division (ENRD) of PW coordinates most environmental concerns at Fort Lewis and its sub-installations. Coordination of solid waste, drinking water, and stormwater matters shall be done with Division, Roads and Sanitation Branch of PW. The Contactor shall make contact with them through PW, Engineering & Contract Management Division.

1.8 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in

the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.9 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G, EC-TB-ET, PM-PL-ER

The environmental protection plan.

SD-06 Test Reports

Hazardous Materials and Hazardous Wastes

Hazardous Materials Inventory Form (initial and ongoing)
Material Safety Data Sheets (MSDSs)
Hazardous Waste Profile Sheets
Hazardous Waste Accumulation Log
Hazardous Waste Manifest

1.10 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

1.10.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall

be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.10.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.

c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

d. Description of the Contractor's environmental protection personnel training program.

e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

h. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

i. Drawing showing the location of borrow areas.

j. The Spill Control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1 and FL 200-1. This plan shall include as a minimum:

1. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer and Fort Lewis Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

6. The methods and procedures to be used for expeditious contaminant cleanup.

k. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic meters or tons along with the percent that was diverted.

l. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

m. An air pollution control plan detailing provisions to assure that

dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

n. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

o. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan shall include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan shall include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

p. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

q. A pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation specific requirements. The Contractor shall follow AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation.

1.10.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached,as an appendix, to the Environmental Protection Plan.

1.11 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.12 SPECIAL ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with the special environmental requirements listed in FL 200-1.

1.13 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings,plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.14 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting

Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, State, Regional, and local environmental laws and regulations.

3.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

3.2.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2.2 Landscape

Shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking orfencing. Trees shall be fenced and signed as required in Section 02220 Demolition. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.2.3 Erosion and Sediment Controls

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated

as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's best management practices shall also be in accordance with the National Pollutant Discharge Elimination System (NPDES) Storm Water Pollution Prevention Plan (SWPPP). Any temporary measures shall be removed after the area has been stabilized.

3.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas.

3.2.5 Tree Protection

All costs associated with tree protection requirements required by specifications and drawings are the full responsibility of the Contractor. The Contractor shall exercise care when excavating trenches in the vicinity of trees. See Section 02220 Demolition for construction restrictions within the Critical Root Zone (CRZ)or dripline of trees. Where roots are 50 mm in diameter or greater, the trench shall be excavated by hand or tunneled. When roots 50 mm or more in diameter are exposed, they shall be wrapped with heavy burlap for protection and to prevent drying. Trenches dug by machines adjacent to trees having roots less than 50 mm in diameter shall have the sides hand trimmed, making a clean cut of the roots. Roots shall be pruned with appropriate horticultural pruning tools. Trenches having exposed tree roots shall be backfilled within 24 hours unless adequately protected by moist burlap or canvas.

3.2.6 Restoration of Landscape Damage & Penalties for Tree Damage

All landscape features (vegetation - such as trees, plants, and grass) damaged or destroyed during Contractor operations outside and within the work areas shall be restored by the Contractor to a condition similar to that which existed prior to construction activities unless otherwise indicated on the drawings or in the specifications. All vegetation that was removed or damaged shall be replaced as indicated below. Landscaping shall be maintained for a minimum of one year after planting, to include irrigation. The Contractor shall coordinate with ENRD prior to planting any non-native species.

Replace any and every tree lost or, in the opinion of the Contracting Officer, irreparably damaged as a result of failure by the Contractor to

protect existing trees. Trees which fail to fully foliate in the first spring following completion of construction operations may be presumed to have been lost due to construction operations. If there is damage to the root system, trunk, or crown of any existing tree to remain that resulted from the Contractor's failure to protect the tree, the Contracting Officer may elect to keep the tree and require that the Government be compensated by the Contractor for damage. The compensation shall be determined by the Guide for Establishing Values of Trees and Other Plants by the Council of Tree and Landscape Appraisers. Damaged trees shall be repaired and follow-up care prescribed by a certified arborist (International Society of Arborists-ISA certified). The certified arborist assessment and repair work shall be provided by the Contractor at their expense.

Any tree killed or irreparably damaged as a result of the Contractor's failure to protect trees, shall be completely removed and disposed of at the Contractor's expense (see Section 02231 Clearing and Grubbing). Trees shall be removed within 5 working days of the determination that they are dead or irreparably damaged. Trees shall be replaced with healthy specimens of the same species and size. In the event a damaged or lost tree cannot be replaced in kind (same species and size), the Contractor shall pay the Government a sum equal to the value of each lost tree as determined by the most current "Guide for Establishing Values of Trees and Other Plants." In addition, a minimum 4-inch caliper nursery stock tree of the same species will be planted as a replacement. Replacement trees shall be planted in approximately the same location as the lost or damaged tree unless otherwise directed by the Contracting Officer.

Shrubs, vines, and ground cover shall be replaced in kind; the Contracting Officer shall approve size. All plant material shall meet specifications outlined in ANSI Z60.1 - current publication, "American Standard for Nursery Stock. Grass areas shall be replaced in kind by seeding or sodding. Sod shall be required in all regularly maintained lawn areas.

3.3 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.3.1 Cofferdams, Diversions, and Dewatering Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to maintain compliance with existing State water quality standards and designated uses of the surface water body. The Contractor shall comply with the State of Washington water quality standards and anti-degradation provisions.

3.3.2 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments.

3.3.3 Wetlands

The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

3.4 Construction Stormwater Permit

The National Pollutant Discharge Elimination System (NPDES), requires general permits, a notice of intent, and a notice of discontinuation for construction sites greater than 5 acres discharging stormwater to any waters of the United States. The Contractor shall file a Notice of Intent with the EPA for coverage under the EPA's general permit for storm water discharges from construction activities. A copy of the NOI shall be submitted to PW, Engineering & Contract Management Division. The Contractor shall be responsible for compliance with the terms of the permit, including the development of a storm water pollution prevention plan.

3.5 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

3.5.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

3.5.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

3.5.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State of Washington rules.

3.5.4 Burning

All cantonment areas, housing areas and all of North Fort are designated as no burn areas. A burning permit is required for burning natural vegetation in all other areas on Fort Lewis. Burning permits may be obtained from the PW Forestry Section. A copy of the permit shall be submitted to PW, Engineering & Contract Management Division.

3.5.5 Fugitive Dust

Fugitive dust created as a result of construction activities shall be controlled with the BACT such as spraying with water. Contractor vehicles shall not enter public roadways with deposits of mud, dirt, or other debris, or unsecured loads.

3.5.6 Painting Operations

Spray painting shall not be conducted except inside a paint booth, which utilizes a dry filter system and is approved by ENRD for use. This requirement does not apply to the use of hand-held aerosol cans, coating of buildings and similar type structures, and painting of other items which ENRD deems can not be sprayed in a paint booth.

3.5.7 Notice of Construction Permits

The Contractor shall be responsible for obtaining any necessary Puget Sound Clean Air Agency "Notice of Construction" permits for the construction/installation of new air emission sources under this project. The Contractor is responsible for the associated fees.

The following process shall be followed when filing a Notice of Construction and Application for Approval. The Contractor shall complete the application including the Environmental Checklist (the proper forms can be obtained from the Puget Sound Clean Air Agency (PSCAA)). The Contractor shall then submit the application and a cashier's check addressed to PSCAA for the associated plan examination fee to PW, Contract & Engineering Management Division. The application and check are to be submitted in a sealed envelope clearly marked with PSCAA Notice of Construction Application and Associated Fee. The Government will review the application. If it is complete and accurate, the Application will be submitted by the Government to PSCAA with check. If it is not complete or accurate, the Contractor will be requested to submit a revised Application. The Contractor shall allow 30 days for review and submission by the Government. After submission, the Contractor shall allow 75 days for review, negotiation, and approval by PSCAA. This process time line applies to standard projects. If the project is a major air pollution source, which requires other environmental documentation and public comment, the process time should be adjusted accordingly.

The Contractor is responsible for assuring all the standards/limits included in the Order of Approval to the Notice of Construction and Application for Approval are implemented or met. This includes developing an Operations and Maintenance plan to assure compliance with all environmental requirements and any testing of the air pollution source, the control equipment, or the monitoring equipment required by the Order of Approval or other regulatory requirement (this may be a supplement to any O&M manuals required elsewhere in the technical specifications).

The address on the Notice of Construction and Application for Approval for the property owner as well as the applicant should be PUBLIC WORKS, ATTN: AFZH-PWE, MS 17E, BOX 339500, FORT LEWIS, WA, 98433-9500.

3.5.8 Best Available Control Technology (BACT)

The Contractor shall utilize the BACT as determined by the regulatory authority on all air pollution sources. The Contracting Officer of their representative shall be notified for resolution if this requires a change in design.

3.6 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.6.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

3.6.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 150 mm of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.6.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by

applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262 and shall manage and store hazardous waste in accordance with the Installation hazardous waste management plan. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer and the Facility Environmental Office. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The Contractor shall coordinate the disposition of hazardous waste with the Facility's Hazardous Waste Manager and the Contracting Officer.

3.6.3.1 Hazardous Waste Management Section (HWMS)

The Contractor shall contact the HWMS at (253) 967-4786 with any questions pertaining to the storage, use, and disposal of Hazardous Materials and/or Hazardous Waste during the execution of this contract.

3.6.3.2 Restricted Use Materials

Certain chemicals are restricted from use on Fort Lewis. These chemicals are listed on the Restricted Use List (RUL). The RUL is maintained by the PW Environmental and Natural Resources Division (ENRD) and is updated semi-annually. A print out and/or an electronic copy of the entire RUL is available from ENRD, Building 1210. The Contractor shall receive authorization from the Contracting Officer or their representative prior to using any product that contains chemicals listed on the RUL. Only materials necessary for and associated with the execution of this Contract will be allowed on Government property.

3.6.3.3 Contingency Planning and Spill Response

The Contractor shall comply with the provisions of the Fort Lewis Spill Prevention, Control and Countermeasures Plan (SPCCP) and the Installation Spill Contingency Plan (ISCP). The PW ENRD maintains these plans. The Contractor shall also maintain on site a written contingency plan for HW accumulation and HM storage areas if the work associated with this contract generates HW or require storage of HM.

3.6.3.4 Transportation of HM and HW

The Contractor shall comply with all Department of Transportation (DOT)

requirements associated with HM/HW, including proper container marking/labeling and vehicle placarding when transporting HM/HW on or off the installation. The Contractor shall obtain Government approval prior to removal of any HW from the installation. Removal shall only be done by an authorized HW transporter having an EPA Identification Number and with the HW recorded on a Uniform Hazardous Waste Manifest (EPA Form 8700-22).

3.6.3.5 HM/HW Personnel and Training Requirements

The Contractor shall appoint an Environmental Compliance Officer (ECO) and a Hazardous Waste Technician (HWT) in writing, if the work associated with this contract causes the Contractor to generate, store, or handle HM/HW. The ECO/HWT shall be responsible for insuring the requirements of this specification are met.

The Contractor shall ensure that all personnel are trained in accordance with Washington Department of Ecology regulations before being assigned to any position handling HW/HM. This training shall include, but not be limited to:

a. Hazardous Materials Use, Storage and Disposal Training Course for ECOs/HWTs. The 8 hour course is available weekly from the Fort Lewis ENRD Hazardous Waste Management Section (HWMS) and shall be taken prior to the Contractor generating, storing, or handling HM or HW on the installation. The Contractor shall contact the HWMS to schedule attendance.
b. First Responder Awareness Level as specified in the ISCP.
c. Quarterly contingency plan review and rehearsal.
d. Hazard Communication training as stated in paragraph 3.2.2.5.

The Contractor shall maintain a record of all required training, and the date conducted, for each individual requiring training and shall make this record available to the Government at all times during the execution of this contract.

3.6.3.6 Hazardous Materials Notification

The Contractor shall provide an initial inventory and MSDS copies for all HM to be used during the execution of this contract, to the PW, Engineering & Contract Management Division. The inventory shall include the type of HM, proposed storage location and quantity to be stored and shall be provided before bringing any HM onto the installation. The Contractor shall use the Hazardous Material Inventory form (HFL Form 953-Enclosure No. 1) or a Contractor-generated form providing the same information. An electronic version of the Hazardous Material Inventory form is available from the PW ENRD in Building 1210.

3.6.3.7 Hazardous Materials Storage Facilities

Facilities shall meet all fire code requirements and provide adequate ventilation, containment, and protection from the elements. Provide warning signs, limit access to the facility, and lock it when it is unattended. Only HM shall be stored in the facility. Contractor vehicles

are not considered a proper storage facility. No HM shall be stored in vehicles overnight or for any length of time.

3.6.3.8 Hazardous Materials Storage and Use

The Contractor shall store HM according to product labels and MSDS requirements. Non-compatible materials shall not be stored together. All containers shall be properly labeled as to contents and kept in good condition with tight fitting lids. Unopened containers shall be segregated from opened containers. Personal protective equipment (PPE) required by the MSDS or product label shall be available and worn by all personnel who handle the product.

3.6.3.9 Hazardous Materials Inspections, Record Keeping and Reporting

The Contractor shall perform weekly inspections of their HM storage facilities utilizing the HM Inspection Checklist (HFL Form 951-Enclosure No. 2). A current inventory of the HM storage facility shall be maintained on site and a copy forwarded to PW, Engineering & Contract Management Division quarterly using the Hazardous Material Inventory form. Additionally, a current MSDS for each product used or stored shall be present and on file at the site where the product is used or stored.

3.6.3.10 Hazard Communication Program

The Contractor shall have a written Hazard Communication program, which explains how personnel are informed and trained concerning HM in the workplace as required by Federal, State and Fort Lewis regulations. The written program shall be located at a hazard communication station that is accessible to all Contractor personnel and shall contain the following sections:

a. A current inventory of HM, who is responsible for classifying a product as a HM, and how the inventory is updated.
b. Labels and other forms of warning: This section shall describe the procedure for insuring that each HM container is clearly labeled and has the appropriate warnings. The section also states who is responsible for labeling requirements and how label information is updated.
c. MSDS file: The location of the MSDS file, who maintains the file, and how personnel may access the file, shall be described. This section shall also describe what is done when a product is received without the MSDS and how the MSDS file is updated.
d. Personnel training and information: This section shall describe initial and refresher training provided to personnel concerning the hazards of the HM in the workplace, the training provided, and who conducts the training.
e. Information to non-Contractor personnel: This section shall describe how non-Contractor personnel are informed about possible hazards, where MSDS copies can be obtained, and what PPE is required in the workplace.

3.6.3.11 Hazardous Waste Identification

The Contractor shall identify all HW generated during the execution of this

contract. The Contractor shall completely characterize the waste stream to identify the waste constituents. Each waste stream identity shall be recorded on a Hazardous Waste Profile Sheet (HWPS) and submitted to PW, Engineering & Contract Management Division for approval prior to waste generation. Profile sheets are available from the HWMS or Contractor generated equivalent sheets may be used. The Contractor is responsible for any costs associated with laboratory analysis to verify the waste stream identity if it is not obviously evident.

3.6.3.12 Hazardous Waste Accumulation

HW shall be accumulated in waste-compatible, sturdy, leak-proof, closed containers that are Department of Transportation (DOT) approved. If the waste is to be disposed of on Fort Lewis, the Contractor shall accumulate wastes only in Government issued HW containers. The Contractor shall contact the HWMS, phone (253) 967-4786 for drums at Fort Lewis.

Each HW container shall be clearly labeled with the words HAZARDOUS WASTE, a description of the waste, and the hazard associated description or label. Any container issued by the HWMS at Fort Lewis shall have a Bar-coded label that contains all necessary labeling information. This label can be obtained by contacting the HWMS.

3.6.3.13 Hazardous Waste Container Management

HW shall be handled in a manner that prevents leaks, spills, fires, and explosions. Container tops and/or bungs shall be serviceable and tightly installed (wrench tight) at all times except when adding material to the container (material should not spill if the container tips over). Containers shall be properly grounded when transferring flammable materials. Containers holding flammable liquids (flash point less than 140 degrees F) shall be grounded. Reactive and ignitable waste containers shall be stored in a manner compatible with NFPA Fire Code requirements. Incompatible wastes shall not be accumulated in the same container or in the same area.

The container accumulation area shall be 50 feet from any other occupied building, shall have overhead cover, and shall be capable of being secured. Access to the area shall be restricted to trained personnel who need to be in and use the area. The site shall be locked when not in use. The container accumulation area shall have a secondary containment system capable of collecting and holding spills and leaks. It shall be sized to hold 110% of the volume of the largest container. A minimum of thirty inches of aisle space shall be maintained between container rows. Container markings and labels shall be clearly visible.

3.6.3.14 Hazardous Waste Inspection, Record Keeping and Reporting

The Contractor shall inspect each accumulation point weekly, utilizing the attached Hazardous Waste Accumulation Areas checklist, (HFL Form 950) to verify compliance with the above requirements. The checklist shall be available on site for inspection.

3.6.3.15 Hazardous Waste Transportation and Disposal

The Contractor shall be responsible for the transportation and disposal off site of all HW generated from the execution of this contract, unless stated otherwise in this specification.

The Contractor or his representative, who provides services that generate, prepare for shipment or transports hazardous waste or provides hazardous waste clean-up/disposal services, shall be responsible for preparing EPA Form 8700-22, Uniform Hazardous Waste Manifest, for the state to which the material is being transported. The Contractor shall comply with all manifest and record keeping and reporting requirements. Specific manifesting procedures include:

a. The Uniform Hazardous Waste Manifest will only be signed by personnel in the HWMS at Building 1210 on Fort Lewis.
b. The Contractor shall provide a copy of the Uniform Hazardous Waste Manifest and supporting documentation (i.e., waste profile and land ban as appropriate) no less than 72 hours in advance of the proposed transporter pick up date.
c. The Contractor shall coordinate and schedule transportation pick up dates and times by contacting the HWMS at (253) 967-4786 or 3268. This will ensure qualified individuals are available for the certification/signature of the manifest and other related documentation. A waste profile (land ban when required) must accompany the manifest to verify description of material being transported.

The Contractor shall be responsible for verifying that the shipment is properly identified (profiled), packaged, marked, labeled, and not leaking. The Contractor shall apply appropriate placards to his vehicle while transporting hazardous materials/waste.

The Contractor shall ensure that the transporter and disposal facility have a valid Environmental Protection Agency identification number for the applicable hazardous waste services, i.e., transportation, treatment, storage, or disposal. The Contractor shall ensure that the transporter drivers have current DOT combination licenses. The Contractor shall ensure that the carrier has instructed and trained personnel concerning the applicable Hazardous Materials Transportation Act (HMTA) regulations relevant to their job functions.

The Contractor or his representatives shall take appropriate action (including cleanup) in the event of a release/spill. If a release/spill occurs on Fort Lewis the Contractor shall immediately notify the Fort Lewis Fire Department (Dial 911). Secondary notification shall be made to (253) 967-4786 or 3268.

The Contractor shall ensure the transporter and disposal facility has liability insurance in effect for claims arising out of death or bodily injury and property damage from hazardous material/waste transport, treatment, storage, and disposal, including vehicle liability and legal defense costs in the amount of $1,000,000.00, as evidenced by a certificate of insurance for General, Automobile, and Environmental Liability Coverage.

3.6.3.16 Hazardous Waste Turn-In

The Contractor shall coordinate turn-in of small quantities of Hazardous Waste. Only HW generated on site as a result of the Contractor's execution of this contract will be accepted. At Fort Lewis, coordination for turn-in shall be made with the HWMS, phone (253) 967-4786.

Containers shall be turned in no later than 90 days after the accumulation start date (earlier if full). All HW that is turned in must be properly identified and characterized, contained, marked/labeled, and (if turned in from a site outside Fort Lewis) manifested. The HWMS will provide assistance to the Contractor at Fort Lewis. This assistance does not free the Contractor from the responsibility of insuring that the waste is identified and managed in accordance with all of the above requirements so that it is acceptable for turn-in. The following procedures shall be followed:

a. Identify the HW. The HW should be one of the waste streams that the activity is permitted to generate and for which a HWPS has been submitted. HM that has become HW shall require the name of the product, the MSDS, the stock number if known, and manufacturer if known, or a completed waste profile analysis.
b. List the type, size, and number of containers, or items (e.g., PCB transformers).
c. Prepare the HW container(s) for turn-in as directed by the HWMS representative. If the container is closed, the HWMS representative may require the Contractor to open the container(s) to verify proper identification of the HW (not applicable to original, factory-sealed containers).
d. Provide certification as to HW identity and container compliance with appropriate regulations. The Contractor's ECO shall sign the certificate.

3.6.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site shall be accordance with FL 200-1 and all Federal, State, and local laws and regulations.

3.6.5 Waste Water

Disposal of waste water shall be as specified below.

a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in

accordance with all Federal, State, Regional and Local laws and regulations.

b. For discharge of ground water, the Contractor shall obtain a State or Federal permit specific for pumping and discharging ground water prior to surface discharging. and then surface discharge in accordance with the requirements of the NPDES or State STORM WATER DISCHARGES FROM CONSTRUCTION SITES permit.

c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing or only hydrostatic testing shall be discharged into the sanitary sewer with prior approval and/or notification to the Waste Water Treatment Plant's Operator.

3.6.6 Polychlorinated biphenyls (PCBs)

3.6.6.1 Transformers

The Contractor shall notify PW, Engineering & Contract Management Division on the day that any electrical transformer is delivered to Fort Lewis. All transformers brought on to Fort Lewis that are fluid filled must contain less than two parts/million (ppm) PCBs and be accompanied by a letter from the manufacturer that indicates that the level of PCBs in the transformer is below two ppm. Copies of all PCB letters and nameplate information shall be provided to PW, Engineering & Contract Management Division.

3.6.6.2 Light Ballasts

The Contractor shall place all PCB light ballasts being removed into a DOT Specification 1A2 drum and turned in as specified for Hazardous Wastes above. All light ballasts removed which are marked, as non-PCB must be disposed of in accordance with Fort Lewis waste designations. This designation can be obtained from the HWMS.

3.6.7 Asbestos Use

No asbestos-containing material shall be installed/used on any structure.

3.6.8 Radiation Safety

All aspects of the job relating to radiation safety, including transportation, use, storage or handling must be addressed by the Contractor through PW, Engineering & Contract Management Division to the Installation Radiation Safety Officer, Installation Safety Office, Building 6069, Fort Lewis, WA, phone: (253) 967-3079/6764.

3.7 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.8 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The Contractor shall submit a report to ENRD through the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following shall be included in the report:

a. Construction and Demolition (C&D) Debris Disposed in cubic meters, as appropriate.

b. Construction and Demolition (C&D) Debris Recycled in cubic meters, as appropriate.

c. Total C&D Debris Generated in cubic meters, as appropriate.

d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) in cubic meters, as appropriate.

3.9 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.10 BIOLOGICAL RESOURCES

The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3.11 INTEGRATED PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, the Contractor, through the Contracting Officer, shall coordinate with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application. The Contractor shall discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC through the COR prior to the application of any pesticide associated with

these specifications. Installation Pest Management personnel shall be given the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.11.1 Pesticide Delivery and Storage

Pesticides shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Pesticides shall be stored according to manufacturer's instructions and under lock and key when unattended.

3.11.2 Qualifications

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

3.11.3 Pesticide Handling Requirements

The Contractor shall formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and shall use the clothing and personal protective equipment specified on the labeling for use during all phases of the application. Material Safety Data Sheets (MSDS) shall be available for all pesticide products.

3.11.4 Application

Pesticides shall be applied by a State Certified Pesticide Applicator in accordance with EPA label restrictions and recommendation. The Certified Applicator shall wear clothing and personal protective equipment as specified on the pesticide label. Water used for formulating shall only come from locations designated by the Contracting Officer. The Contractor shall not allow the equipment to overflow. Prior to application of pesticide, all equipment shall be inspected for leaks, clogging, wear, or damage and shall be repaired prior to being used.

3.12 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

3.13 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.14 MILITARY MUNITIONS

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that area and immediately inform the Contracting Officer.

3.15 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.16 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

SECTION 01356

STORM WATER POLLUTION PREVENTION MEASURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4439	(2002) Geosynthetics
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01355 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include geotextiles, sod stabilization, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g.,); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent

by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of -18 to 49 degrees C. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	445 N min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	245 N min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 50 mm by 50 mm when oak is used and 100 mm by 100 mm when pine is used, and shall have a minimum length of 1.5 m. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum mass of 1.98 kg per linear meter and a minimum length of 1.5 m.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 350 mm by 450 mm. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum

dimensions of 50 mm by 50 mm in cross section and shall have a minimum length of 1 m. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum mass of 1.98 kg per linear meter and a minimum length of 1 m .

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 400 mm above the ground surface and shall not exceed 860 mm above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 150 mm overlap, and securely sealed. A trench shall be excavated approximately 100 mm wide and 100 mm deep on the upslope side of the location of the silt fence. The 100 mm by 100 mm trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 100 mm. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 100 mm against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 450 mm deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid

to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02921 SEEDING, except that the coverage requirements in paragraph ESTABLISHMENT do not apply.

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02921 SEEDING.

3.3.3 Diversion Dike Maintenance

Diversion dikes shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged diversion dikes and necessary repairs shall be accomplished promptly. When diversion dikes are no longer required, they shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02921 SEEDING.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 13 mm or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures

are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

SECTION 01415

METRIC MEASUREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 380	(1993) Practice for Use of the International System of Units (SI)
ASTM E 621	(1999 el) Practice for Use of Metric (SI) Units in Building Design and Construction

1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. A number of circumstances require that both metric SI units and English inch-pound (I-P) units be included in a section of the specifications. When both metric and I-P measurements are included, the section may contain measurements for products that are manufactured to I-P dimensions and then expressed in mathematically converted metric value (soft metric) or, it may contain measurements for products that are manufactured to an industry recognized rounded metric (hard metric) dimensions but are allowed to be substituted by I-P products to comply with the law. Dual measurements are also included to indicate industry and/or Government standards, test values or other controlling factors, such as the code requirements where I-P values are needed for clarity or to trace back to the referenced standards, test values or codes. For American Society for Testing and Materials (ASTM) references in the technical specifications, the Contractor shall use the metric publication, if one is available (For example: ASTM A 36, use ASTM A 36M). An acceptable substitute to hard Metric SI Concrete Masonry Units (CMU) and Recessed Lighting Fixtures (RLF) is English in-pound (soft metric) CMU and RLF. The Contractor shall be responsible for any adjustments required to accommodate these alternative English in-pound units at no additional cost to the Government.

1.3 USE OF MEASUREMENTS

Measurements shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. The Contractor shall

be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value, i.e., where an SI value is not an exact mathematical conversion of an I-P value, such as the use of 100 mm in lieu of 4 inches. Hard metric products are required when only metric dimensions are indicated, except for Contractor's options as outlined in paragraph GENERAL above. Hard metric measurements are often used for field data such as distance from one point to another or distance above the floor. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

1.3.2 Soft Metric

a. A soft metric measurement is indicated by an SI value which is a mathematical conversion of the I-P value shown in parentheses e.g. 38.1 mm (1-1/2 inches). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.

b. A soft metric measurement is also indicated for products that are manufactured in industry designated metric dimensions but are required by law to allow substitute I-P products. These measurements are indicated by a manufacturing hard metric product dimension followed by the substitute I-P equivalent value in parentheses e.g., 190 x 190 x 390 mm (7-5/8 x 7-5/8 x 15-5/8 inches).

1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g., American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM E 380 and ASTM E 621 as the basis for establishing metric measurements

required to be used in submittals.

PART 2 NOT USED
PART 3 NOT USED

-- End of Section --

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1999b) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2002) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

CQC Laboratory Validation; G

Quality Control Plan; G

1.3 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

1.4 LABORATORY VALIDATION

The testing laboratory shall be validated by Corps of Engineers Material Testing Center (MTC) for all tests required by contract. See paragraph 3.7 TESTS.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to

adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization.The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a construction person with a minimum of 10 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC

System Manager.

3.4.3 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered at AGC offices throughout the state of Washington and Oregon. The certificate for completion of this course expires five years after date of issue; a CQC System Manager whose certificate has expired must take the class again to be recertified.

3.4.4 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements. When Sections 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; or 15995 COMMISSIONING OF BUILDING SYSTEMS are included in the contract, the submittals required by these sections shall be coordinated with Section 01330 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required. All Contractor forms for submitting test results are subject to Contracting Officer approval.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Minimum testing frequencies shall be according to Table 1. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and

comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

a. Validation

The testing laboratory shall be validated by the Corps of Engineers Materials Testing Center (MTC) for all tests required by the contract prior to the performance of any such testing. The validation of a laboratory is site specific and cannot be transferred or carried over to a facility at a different location. Any and all costs associated with this Government laboratory validation shall be borne by the laboratory and/or the Contractor. Validation of a laboratory is not granted for the entire laboratory activity, but only for the specific procedures requested by the inspected laboratory. The inspected laboratory has full choice of the procedures to be inspected except that the Quality Assurance portion of ASTM E 329 is mandatory to be inspected.

(1) Validation Procedures

Validation of a laboratory may consist of either an inspection or audit as defined herein. Validation of all material testing laboratories shall be performed by the MTC. Validation may be accomplished by one of the following processes:

(a) Inspection. Inspection shall be performed by the MTC in accordance with American Society for Testing and Materials (ASTM) standards ASTM E 329 and ASTM D 3740.

(b) Audit. A laboratory may be validated by auditing if it has been accredited by the Concrete and Cement Reference Laboratory (CCRL) or AASHTO Materials Reference Laboratory (AMRL) within the past two years in accordance with ASTM E329. Audit shall be performed by the MTC. Inspection by MTC may be required after auditing if one or more of the critical testing procedures required in the project specification were not included in the

CCRL or AMRL inspection report or if there is any concern that the laboratory may not be able to provide required services.

b. Standards of Acceptability

(1) Aggregate, concrete, bituminous materials, soil, and rock. Laboratories for testing aggregate, concrete, bituminous materials, soil, and rock shall be validated for compliance with ASTM E 329, Engineer Manual (EM) 1110-2-1906, or project specifications, as applicable.

(2) Water, sediment, and other samples. Laboratories engaged in analysis of water, sediment, and other samples for chemical analysis shah be inspected to assure that they have the capability to perform analyses and quality control procedures described in references in Appendix A as appropriate. The use of analytical methods for procedures not addressed in these references will be evaluated by the CQAB for conformance with project or program requirements.

(3) Steel and other construction materials, Laboratories testing steel and other construction materials shall be validated for capabilities to perform tests required by project requirements and for compliance with ASTM E 329.

c. Validation Schedule

(1) For all contracted laboratories and project Quality Assurance (QA) laboratories testing aggregate, concrete, bituminous materials, soils, rock, and other construction materials, an initial validation shall be performed prior to performance of testing and at least every two (2) years thereafter.

(2) Laboratories performing water quality, wastewater, sludge, and sediment testing shall be approved at an interval not to exceed eighteen (18) months.

(3) All laboratories shall be revalidated at any time at the discretion of the Corps of Engineers when conditions are judged to differ substantially from the conditions when last validated.

d. Validation Process

If a validated laboratory is unavailable or the Contractor selects to use a laboratory which has not been previously validated, Contractor shall coordinate with Corps of Engineers Material Testing Center (MTC) to obtain validation and pay all associated costs. Point of contact at MTC is Daniel Leavell, telephone (601) 634-2496, fax (601) 634-4656, email daniel.a.leavell@erdc.usace.army.mil, at the following address:

U.S. Army Corps of Engineers
Materials Testing Center
Waterways Experiment Station
3909 Hall Ferry Road
Vicksburg, MS 39180-6199

Procedure for Corps of Engineers validation, including qualifications and inspection/audit request forms are available at the MTC web site:

http://www.wes.army.mil/SL/MTC/mtc.htm

Contractor shall coordinate directly with the MTC to obtain validation. Contractor is cautioned the validation process is complicated and lengthy, may require an onsite inspection by MTC staff, correction of identified deficiencies, and the submittal and approval of significant documentation. Estimate a minimum of 60 days to schedule an inspection/submittal and receive a validation. Schedule of costs:

Full Onsite Inspection	1 - 15 procedures	$3500 + travel expenses
	16 - 40 procedures	$4500 + travel expenses
	41 + procedures	$5500 + travel expenses
Full Desk Audit (AASHTO inspected)		$3000
Abbreviated Audit by AASHTO Accreditation		$1500
Additional Procedures after Validation		$500 each to a maximum of four procedures; more than four additional procedures calls for an onsite inspection of the additional procedures.

Travel time and associated costs will be determined from Vicksburg MS. The Contractor will be invoiced for actual travel costs and shall submit payment direct to the MTC made payable to the ERDC Finance and Accounting Officer prior to the scheduling of the inspection and/or audit. The Contractor shall copy the Contracting Officer of all correspondence and submittals to the MTC for purposes of laboratory validation.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

U.S. Army Corps of Engineers
Materials Testing Center
Waterways Experiment Station
3909 Hall Ferry Road
Vicksburg, MS 39180-6199
Phone: (601) 634-2496 or (601) 634-3261

ATTN: Project _____, Contract Number _____

Coordination for each specific test, exact delivery location and dates will be made through the Area Office. If samples are scheduled to arrive at the laboratory on a weekend (after 1700 Friday through Sunday) notify the laboratory at least 24 hours in advance at (601) 634-2496 to arrange for delivery.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date

scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and

submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

(sample of typical Contractor's Daily Report)
DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract Number: _____ Date: _____ Rpt. No._____

Contract Title: _____ Location: _____

Weather: Clear __ P. Cloudy __ Cloudy __ Rainfall __ (__% of workday)

Temperature during workday: High ____ degrees F. Low ___ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work performed

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):

_____

_____

_____

_____

4. QUALITY CONTROL TESTING AND RESULTS (comment on tests and attach test reports):

_____

5. DAILY SAFETY INSPECTIONS (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):

6. REMARKS (Include conversations with or instructions from the Government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

CONTRACTOR QC REPRESENTATIVE

(Sample of Typical Contractor's Test Report)

TEST REPORT

STRUCTURE OR BUILDING _____

CONTRACT NO. _____

DESCRIPTION OF ITEM, SYSTEM, OR PART OF SYSTEM TESTED:
_____

_____

DESCRIPTION OF TEST: _____

_____

_____
NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TESTS FOR THE CONTRACTOR:

NAME_____

TITLE_____

SIGNATURE_____

I HEREBY CERTIFY THAT THE ABOVE DESCRIBED ITEM, SYSTEM, OR PART OF SYSTEM HAS BEEN TESTED AS INDICATED ABOVE AND FOUND TO BE ENTIRELY SATISFACTORY AS REQUIRED IN THE CONTRACT SPECIFICATIONS.

SIGNATURE OF CONTRACTOR
QUALITY CONTROL
INSPECTOR_____

DATE_____

REMARKS
_____

_____

_____

-- End of Section --

TABLE 1

MINIMUM SAMPLING AND TESTING FREQUENCY

Materials	Test	Minimum Sampling and Testing Frequency
Fills, Embankments, Backfills, Subgrade, Subbase, and Base Course Material		
Fill and Embankment	Field Density2/12/	Two tests per lift for each increment or fraction of 1,672 square meters (2000 sy) and any time material type changes.
	Lab Density3/	One test initially per each type of materials or blended material and any time material type changes, and one every 10 field density tests.
	Gradation1/	One test every 153 cubic meters (200 cubic yards) of fill for each type of materials or blended material and any time material type changes.
Subgrade	Field Density2/12/	One test per each increment or fraction of 1,672 square meters (2000 s.y.)
	Lab Density3/	One test every 10 field density tests.
Backfill for Culverts, Trenches, Buildings and Walls, Pavements, and Other Structures	Field Density2/12/	Culverts: One test per each lift.
		Trenches: One test per lift for each increment or fraction of 152 lineal meters (500 linear feet) for backfill. Under pavements, one test every lift and at every crossing.
		Walls and Buildings Perimeters, Including Footings: One test per lift for each increment or fraction of 61 lineal meters (200 linear feet) of backfill.
		Buildings Slabs on Grade: One test per lift for each increment or faction of 93 square meters (1000 s.f.)

Materials	Test	Minimum Sampling and Testing Frequency
		Areas enclosed by grade beams, compacted with power driven hand operated compactors: One test per lift for each increment or fraction of 46 square meters (500 s.f.) Pavements: Two tests per lift for each increment or fraction of 1,672 square meters (2000 s.y.) Other Structures: One test per lift for each increment or fraction of 61 lineal meters (200 linear feet) of backfill.
	Lab Density[3/]	One test initially per each type of material or blended material and one every 10 field density tests.
	Gradation[1/]	One test per each type of material or blended material and one every 10 field density tests.
Subbase and Base	Gradation[1/](including .02 mm particles size limits.	1 sample for every 3,345 square meters (4,000 sy.)
	In-Place Density[2/] [12/]	1 sample every 1,672 square meters (2,000 sy.)
	Moisture-Density Relationship[3/]	1 initially and every 20 density tests.
	Portland Cement Concrete	
Coarse and Fine Aggregate[7/]	Moisture, specific gravity and absorption[8/]	1 initially.
	Gradation and fineness modules	1 every 191 cubic meters (250 cy) of concrete.
	Moisture, specific gravity and absorption[8/]	(same as coarse aggregate).
Concrete	Slump	Conduct test every day of placement and for every 19 cubic meters (25 cy) and more frequently if batching appears inconsistent. Conduct with strength tests.

Materials	Test	Minimum Sampling and Testing Frequency
	Entrained Air	Conduct with slump test.
	Ambient and concrete temperatures	Conduct with slump tests.
	Unit weight, yield, and water cement ratio	Conduct with strength tests. Check unit weight and adjust aggregate weights to ensure proper yield.
	Flexural strength and evaluation	When specified for slabs on grade or for concrete pavements, take one set of 6 beams every 76 cubic meters (100 cy) of concrete with a minimum of 1 set per day. Two beams shall be tested at 7 days, two at 28 days, and two at 90 days.
	Compressive strength	One set of 3 cylinders per day and every 76 cubic meters (100 cy) for each class of structural concrete. Test one cylinder at 7 days and two at 28 days. Additional field cure cylinders shall be made when insitu strengths are required to be known.
Vibrators	Frequency and amplitude	Check frequency and amplitude initially and any time vibration is questionable.

NOTES:

1/All acceptance tests shall be conducted from in-place samples.
2/Additional tests shall be conducted when variations occur due to the contractors operations, weather conditions, site conditions, etc.
3/Classification (ASTM D-2487), moisture contents, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable.
4/Materials to be submitted only upon request by the Contracting Officer.
5/Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.
6/Increase quantities by 50 percent for Paving mixes and by 100 percent for Government testing of admixtures. Include standard deviation for similar mixes from the intended batch plant and data from a minimum of 30 tests, if available. Refer to ACI 214.
7/A petrographic report for aggregate is required with the sample for source approval. If the total amount of all types of concrete is less than 153 cubic meters (200 c.y.) service records from three separate structures in similar environments which used the aggregates may substitute for the petrographic report.
8/Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for w/c calculations.
9/For less than 1,000 units, the above test may be waived at the discretion of the Contracting Officer and acceptance based on manufacturers certification and test report.
10/Additional tests shall be performed when changes are made either in the manufacturing processes or in materials used in the production of the masonry units.
11/If adequate storage protection is not provided at the jobsite, additional tests shall be made to determine that the allowable moisture condition has not been exceeded before the blocks can be placed in the structure.
12/The nuclear densometer, if properly calibrated, may be used but only in addition to the required testing frequency and procedures using sandcones. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.

SECTION 01452

SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Special Inspector; G

Certification attesting that the Special Inspector is qualified by knowledge and experience to perform the specified Special Inspections. Information, which provides evidence of the knowledge and experience necessary to qualify a person as a Special Inspector for the category of work being certified, will accompany the qualification.

Quality Assurance Plan; G

A copy of the Quality Assurance Plan covered by a certificate indicating that the plan meets the content specified in this section.

1.2 SPECIAL INSPECTOR

A Special Inspector shall be used to perform Special Inspections required by this section. The Special Inspector is a person employed by the Contractor and approved by the Government as being qualified by knowledge and experience to perform the Special Inspection for the category of work being constructed. Special Inspectors shall perform their duties independent from the construction quality control staff employed by the Contractor. More than one Special Inspector may be required to provide the varied knowledge and experience necessary to adequately inspect all of the categories of work requiring Special Inspection.

1.3 QUALITY ASSURANCE PLAN

A quality assurance plan shall be developed containing the following:

a. A list of all items that require quality assurance Special Inspection and testing, including the type, frequency, extent, and duration of the special inspection for each item on this list.

b. A list of all items that require quality assurance testing, including the type and frequency of testing for each item on this list.

c. The content, distribution, and frequency of special inspection reports.

d. The content, distribution, and frequency of testing reports.

e. The procedures, controls, and people used within the Contractor's organization to develop, sign, and distribute Special Inspection and Testing reports along with the position title and pertinent qualifications of all Contractor personnel involved.

1.4 SPECIAL INSPECTION

The Special Inspection for seismic-resisting system components shall be done as specified. Special Inspector personnel shall be in addition to the quality control inspections and inspectors required elsewhere in this section.

1.4.1 Continuous Special Inspection

Continuous special inspection is the full time observation of the work by the Special Inspector present in the work area whenever work is being performed. Continuous special inspection shall be performed where specified for items as shown on the drawings.

1.4.2 Perodic Special Inspection

Perodic special inspection is the intermittent observation of the work by a Special Inspector present in the work area while work is being performed. The intermittent observation periods shall be at times of significant work, shall be recurrent over the complete work period, and shall total at least 25 percent of the total work time. Perodic special inspection shall be performed where specified for items as shown on the drawings.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PERFORMANCE OF INSPECTIONS

Special Inspections shall be performed for the following where designated on the drawings:

3.1.1 Soils

a. Periodic special inspection during and on completion of grading, excavation and fill, and final foundation preparation.

3.1.2 Structural Concrete

a. Continuous inspection during reinforcing welding, preparation of test specimens, concrete placement, adhesive anchor placement and expansion anchor placement.

b. Periodic special inspection during and on completion of the placement of foundation reinforcement placement, reinforcing couplings, anchor bolts and inserts, and embedded plates.

3.1.3 Structural Wood

a. Continuous special inspection during all field gluing operations of elements of the seismic-force-resisting system.

b. Periodic special inspections for nailing, bolting, anchoring, and other fastening of components within the seismic-force-resisting system including drag struts, braces, and tie-downs. Periodic inspections of prefabricated elements including glulam members and structural insulated panel system.

3.1.4 Welding

a. Continuous special inspection of fillet welds greater than 7.9 mm.

b. Periodic special inspections for all single pass fillet welds less than 7.9 mm.

3.1.5 Architectural Components

Special inspection of the architectural components shall assure that the methods of anchoring and fastening indicated on the drawings are being complied with at the onset of construction of the components, and that the specified or shown number, spacing, and types of fasteners were actually installed. Special inspection for architectural components shall be as follows:

a. Periodic special inspection during the erection and fastening of exterior metal siding, structural standing seam metal roofing, interior nonloadbearing partition walls greater than 4 000 mm tall, exterior nonloadbearing walls and masonry veneer.

b. Periodic special inspection during the anchorage of suspended ceilings, suspended light fixtures, prefabricated baptistery and prefabricated steeple.

3.1.6 Mechanical and Electrical Components

Special inspection of the mechanical and electrical components shall assure that the methods of anchoring and fastening indicated on the drawings are being complied with at the onset of construction of the component, and that the specified or shown number, spacing, and types of fasteners were actually installed. Special inspection for mechanical and electrical components shall be as follows:

a. Periodic special inspection during the anchorage of electrical equipment for emergency or standby power systems.

b. Periodic special inspection during the installation of anchorage of all other electrical equipment.

c. Periodic special inspection during installation for flammable, combustible, or highly toxic piping systems and their associated mechanical units.

d. Periodic special inspection during the installation of HVAC ductwork that will contain hazardous materials.

3.2 REPORTING AND COMPLIANCE PROCEDURES

a. On the first day of each month, the Contractor shall furnish to the Government five copies of the combined progress reports of the special inspector's observations. These progress reports shall list all special inspections of construction or reviews of testing performed during that month, note all uncorrected deficiencies, and describe the corrections made both to these deficiencies and to previously reported deficiencies. Each monthly report shall be signed by all special inspectors who performed special inspections of construction or reviewed testing during that month, regardless of whether they reported any deficiencies . Each monthly report shall be signed by the Contractor.

b. At completion of construction, each special inspector shall prepare and sign a final report attesting that all work they inspected and all testing and test reports they reviewed were completed in accordance with the approved construction documents and that deficiencies identified were satisfactorily corrected. The Contractor shall submit a combined final report containing the signed final reports of all the special inspectors. The Contractor shall sign the combined final report attesting that all final reports of special inspectors that performed work to comply with these construction documents are contained therein, and that the Contractor has reviewed and approved all of the individual inspector's final reports.

-- End of Section --

SECTION 01501

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

Temporary Power Services Diagram; G

1.2 AVAILABILITY AND USE OF UTILITY SERVICES AT FORT LEWIS

No utility services are furnished without charge at Fort Lewis unless otherwise specifically stated in the contract. For utilities to be purchased from Government, the contractor shall enter into a utility sales agreement with the Government. The cost of each utility service obtained from the Government, shall be paid for by the Contractor at prevailing rates, as determined by the Utility Sales Officer. The Contractor shall furnish, install and maintain all necessary meters, regulating equipment and service connections to each utility system. For utility services, to be purchased from the Government, plans for all such facilities shall be subject to the approval of the Utility Sales Officer (or designee) and installation of such facilities shall be subject to his/her supervision (or designee's). The Utility Sales Officer (or designee) will read the meters. The Installation Utility Sales Officer can be reached at (253) 966-1741. Natural gas requirements at Ft. Lewis shall be coordinated with and obtained from Puget Sound Energy. (Utility services obtained from private service providers at Ft. Lewis shall be coordinated with and obtained from the particular private provider.)

1.3 SANITARY PROVISIONS

Contractor shall provide sanitary accommodations for the use of employees as may be necessary and shall maintain accommodations approved by the Contracting Officer and shall comply with the requirements and regulations of the State Health Department, County Sanitarian, or other authorities having jurisdiction.

1.4 TEMPORARY ELECTRIC WIRING

1.3.1 Temporary Power and Lighting

The Contractor shall provide construction power facilities in accordance with the safety requirements of the National Electric Code NFPA No. 70 and the SAFETY AND HEALTH REQUIREMENTS MANUAL EM 385-1-1. The Contractor, or its delegated subcontractor, shall enforce the safety requirements of

electrical extensions for the work of subcontractors. Work shall be accomplished by journeyman electricians.

1.3.2 Construction Equipment

In addition to the requirements of SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, temporary wiring conductors installed for operation of construction tools and equipment shall be either Type TW or THW contained in metal raceways, or shall be hard usage or extra hard usage multiconductor cord. Temporary wiring shall be secured above the ground or floor in a workmanlike manner and shall not present an obstacle to persons or equipment. Open wiring may only be used outside of buildings, and then only in accordance with the provisions of the National Electric Code.

1.3.3 Submittals

Submit detailed drawings of temporary power connections. Drawings shall include, but not be limited to, main disconnect, grounding, service drops, service entrance conductors, feeders, GFCI'S, and all site trailer connections.

1.5 FIRE PROTECTION

During the construction period, the Contractor shall provide fire extinguishers in accordance with the safety requirements of the SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1. The Contractor shall remove the fire extinguishers at the completion of construction.

1.6 UTILITY LOCATOR/IDENTIFICATION TAPE

Unless specified otherwise elsewhere in the Contract, all installed utility lines shall have a plastic marker tape (minimum 150 mm wide and 0.125 mm thick, installed 200 mm to 260 mm below grade. The plastic marker tape shall include a metallic wire or metal foil backing for detection purposes, and shall bear a continuous printed inscription describing the type of utility line buried below. All underground exterior gas lines shall be provided with a continuous tracer wire (#12 wire) taped to the pipe. Utility line monument markers (concrete with brass identification plugs) shall be installed every 60 meters along straight runs and at each change of direction. Any existing marker tapes or tracer wires damaged during construction shall be repaired to original condition.

1.7 STAGING AREA

Contractor will be provided adequate open staging area as directed by the Contracting Officer. Area is unsecured, and Contractor shall make provisions for its own security.

Contractor shall be responsible for keeping staging area, and office area clean and free of weeds and uncontrolled vegetation growth. Weeds shall be removed by pulling or cutting to within 1-inch of ground level. Lawn areas shall be mown to keep growth to less than 2-inches. All loose debris and material subject to being moved by prevailing winds in the area shall be picked up or secured at all times.

If the area is not maintained in a safe and clean condition as defined above the Contracting Officer may have the area cleaned by others with the costs being deducted from the Contractor's payment.

1.8 HOUSEKEEPING AND CLEANUP

Pursuant to the requirements of Clause CLEANING UP and Clause ACCIDENT PREVENTION, of the CONTRACT CLAUSES, the Contractor shall assign sufficient personnel to ensure compliance. The Contractor shall submit a detailed written plan for implementation of this requirement. The plan will be presented as part of the preconstruction safety plan and will provide for keeping the total construction site, structures, and accessways free of debris and obstructions at all times. Work will not be allowed in those areas that, in the opinion of the Contracting Officer, have unsatisfactory cleanup and housekeeping at the end of the preceding day's normal work shift. At least once each day all areas shall be checked by the Quality Control person of the Contractor and the findings recorded on the Quality Control Daily Report. In addition, the Quality Control person shall take immediate action to ensure compliance with this requirement. Housekeeping and cleanup shall be assigned by the Contractor to specific personnel. The name(s) of the personnel shall be available at the project site.

1.9 DIGGING PERMIT

Before performing any onsite excavation, Contractor shall obtain a digging permit. The digging permit can be obtained at Directorate of Public Works, Building 2012, room 110, telephone 253-967-5237, on weekdays between 8 a.m. and 3:30 p.m. Typically it will take a Contractor 3-5 working days to collect all signatures necessary for clearances prior to the permit being issued.

1.10 CONSTRUCTION NEAR COMMUNICATIONS CABLES

1.9.1 Excavation Near Communication Cables

Digging within.9144 meters (3 feet) of communication cables (including fiber optic cables) shall be performed by hand digging until the cable is exposed. The Contracting Officer shall be notified a minimum 3 days prior to digging within a .9144 meter (3-foot) area near cable. The cable route will be marked by the Government prior to excavation in the area. A digging permit shall be obtained by the Contractor before performing any excavation. The Contractor shall be held responsible for any damage to the cable by excavation procedures. Once the cable is exposed, mechanical excavation may be used if there is no chance of damage occurring to the cable.

1.9.2 Reburial of Exposed Utilities

When existing utility lines are reburied a locator/identification tape, detectable by pipe detector systems, shall be installed above the uncovered length of the utility. See paragraph UTILITY LOCATOR/IDENTIFICATION TAPE above for detailed tape and installation requirements.

1.9.3 Access to Communications Manhole or Handhole

No communications manhole or handhole shall be entered without first obtaining a fiber optic cable briefing. Coordinate through the Contracting Officer with DOIM (Directorate of Information Management), Fort Lewis, Information Services Center, Bldg. 2003 .

1.9.4 Cable Cuts or Damage

If a communications cable is cut or damaged the Contractor shall immediately notify the Contracting Officer (CO) and begin gathering personnel and equipment necessary to repair the cut, or damage. Contractor shall begin repairs within one hour of the cut or damage, unless notified otherwise, and continue repairs without interruption until full service is restored.

1.11 PROJECT SIGN

Contractor shall furnish and install one project sign in accordance with conditions hereinafter specified and layout shown on drawing No. 49s-40-05-15, Sheets 1 and 2, except Corps of Engineers' castle and Department of Army seal will be Government furnished. All letters shall be block type, upper case. Letters shall be painted as indicated using exterior-type paint. Sign shall be maintained in excellent condition throughout the life of job. Project sign shall be located as directed. Upon completion of project, sign shall be removed and shall remain the property of Contractor.

1.12 CONCEALED WORK

All items of work to be concealed shall be Government inspected prior to concealment.

1.13 REPAIR OF ROAD CUTS

Asphaltic surface shall be completely in place within 48 hours after placement of base gravel. Between placement of base gravel and pavement, road shall be kept in drivable and passable condition.

1.14 ELEVATED WORK AREAS

Workers in elevated work areas in excess of 2 meters above an adjoining surface require special safety attention. In addition to the provisions of SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, the following safety measures are required to be submitted to the Contracting Officer's Representative. Prior to commencement of work in elevated work areas, the Contractor shall submit drawings depicting all provisions of his positive

fall protection system including, but not limited to, all details of guardrails. Positive protection for workmen engaged in the installation of structural steel and steel joist shall be provided by safety nets, tie-offs, hydraulic man lifts, scaffolds, or other required means. Decking crews must be tied-off or work over nets or platforms not over 2 meters (6 feet) below the work area. Walking on beams and/or girders and the climbing of columns is prohibited without positive protection. Perimeter guardrails shall be installed at floor, roof, or wall openings more than 2 meters (6 feet) above an adjoining surface and on roof perimeters. Rails shall be designed to protect all phases of elevated work including, but not limited to, roofing operations and installation of gutters and flashing. Rails around roofs may not be removed until all work on the roof is complete and all traffic on or across the roof ceases. Rails shall be designed by a licensed engineer to provide adequate stability under any anticipated impact loading. As a minimum, the rails shall consist of a top rail at a height of 1067 mm (42 inches), a mid-rail, and a toe board. Use of tie-offs, hydraulic man lifts, scaffolds, or other means of roof edge protection methods may be utilized on small structures such as family housing, prefabricated metal buildings, etc. If safety belts and harnesses are used, the positive fall protection plan will address fall restraint versus fall arrest. Body belts will ONLY be used for fall restraint; they will not be used for fall arrest.

1.15 TRAFFIC CONTROL

The Contractor shall provide for movement of traffic through and around the construction zone in a manner that is conducive to the safety of motorists, pedestrians, and workers. This shall include placement and maintenance of traffic control devices in accordance with the U.S. Department of Transportation, Federal Highway Administration publication, Manual on Uniform Traffic Control Devices. Streets (except dead end) may be closed to traffic temporarily by approved written request to the Contracting Officer at least 10 working days prior to street closure. Street closures shall at all times allow street access to a building from one direction. Excavations shall not remain open for more than 1 working day without approval.

1.16 UTILITIES NOT SHOWN

The Contractor can expect to encounter, within the construction limits of the entire project, utilities not shown on the drawings and not visible as to the date of this contract. The Contractor shall scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing utilities are discovered. The Contractor shall verify the elevations of existing utilities, piping and any type of underground obstruction not indicated, or indicated and not specified to be removed. If such utilities interfere with construction operations, he shall immediately notify the Contracting Officer verbally and then in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are removed or relocated as directed, the Contractor shall be entitled to equitable adjustment for any additional work or delay. The types of utilities the Contractor may encounter are waterlines, sewer lines (storm and sanitary),

gas lines, fueling lines, steam lines, buried fuel tanks, septic tanks, other buried tanks, communication lines, cathodic protection cabling, and power lines. These utilities may be active or abandoned utilities.

1.17 GOVERNMENT WITNESSING AND SCHEDULING OF TESTING

The Contractor shall notify the Contracting Officer, by serial letter, of dates and agenda of all performance testing of the following systems: mechanical (including fire protection and EMCS), electrical (including fire protection) medical and food service systems a minimum of 10 calendar days prior to start of such testing. In this notification, the Contractor shall certify that all equipment, materials, and personnel necessary to conduct such testing will be available on the scheduled date and that the systems have been prechecked by him and are ready for performance and/or acceptance testing. Contractor shall also confirm that all operations and maintenance manuals have been submitted and approved. NO PERFORMANCE AND/OR ACCEPTANCE TESTING WILL BE PERMITTED UNTIL THE OPERATIONS AND MAINTENANCE MANUALS HAVE BEEN APPROVED.

Government personnel, at the option of the Government, will travel to the site to witness testing. If the testing must be postponed or canceled for whatever reason not the fault of the government, the Contractor shall provide the Government not less than 3 working days advance notice (notice may be faxed) of this postponement or cancellation. Should this 3 working day notice not be given, the Contractor shall reimburse the Government for any and all out of pocket expenses incurred for making arrangements to witness such testing including, but not limited to airline, rental car, meal, and lodging expenses. Should testing be conducted, but fail and have to be rescheduled for any reason not the fault of the Government, the Contractor shall similarly reimburse the Government for all expenses incurred.

1.18 HARD HAT SIGNS

The Contractor shall provide 610 mm by 610 mm (24 by 24 inch) square Hard Hat Area signs at each entry to the project or work area as directed by the Contracting Officer. A minimum of two signs will be required. Signs shall be in accordance with the sketch at the end of this section.

1.19 FIELD OFFICE TRAILER

The Contractor shall furnish a trailer, approximately 14 feet by 50 feet, in a location designated by and for the use of the Contracting Officer. The trailer shall be furnished with two desks. One desk shall be 5 feet long by 3 feet wide, with a side drawer and a center drawer that can be locked. The second desk shall be 3 feet by 4 feet minimum, suitable for laying out full-scale contract plans. Two chairs and one stool shall be furnished.. A wall locker shall be furnished which is suitable for hanging coats and rain gear and as general storage. It shall be 60 inches to 72 inches high, 18 inches to 24 inches wide, and 18 inches deep (minimum). The building shall have two windows and shall have a door with a lock set with two keys. Each window shall have not less than 6 square feet of glass area, and the door shall be 2 feet, 8 inches wide by 6 feet, 8 inches high. Contractor shall provide a ten pound, multipurpose, dry chemical fire

extinguisher, rated for type A, B, and C fires. Extinguisher shall be mounted at a strategic location, coordinated with the Contracting Officer. The Contractor shall furnish and maintain adequate electric lights and wall outlets, heat, ventilation, air-conditioning, and drinking water for the building, and shall perform any necessary maintenance and disposal of waste to the building. Drinking water shall be either supplied and maintained daily in insulated water can or be provided via piping to an indoor sink. Suitable enclosed sanitary toilet and lavatory facilities shall be furnished in the immediate vicinity of the building and kept clean by the Contractor. Contractor shall be responsible for installing all utility hookups, tie downs, skirting, slabs, foundations, steps and landings as necessary to meet all local, county, state and federal codes and regulations. The trailer will remain property of the Contractor and shall be removed from the site upon completion of the project. (As an alternative, the office space may be a lockable room within a larger structure. This office space shall meet all other requirements of this paragraph.)

PART 2 (NOT APPLICABLE)

PART 3 (NOT APPLICABLE)

-- End of Section --

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SECTION 01525

SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z359.1	(1992; R 1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
ASME B30.3	(1996) Construction Tower Cranes

ASME INTERNATIONAL (ASME)

ASME B30.22	(2000) Articulating Boom Cranes
ASME B30.5	(2000) Mobile and Locomotive Cranes
ASME B30.8	(2000) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2002) Portable Fire Extinguishers
NFPA 241	(2000) Safeguarding Construction,Alteration, and Demolition Operations
NFPA 51B	(2003) Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2005) National Electrical Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces

29 CFR 1910.94	Ventilation
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall Protection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

Activity Hazard Analysis (AHA); G

Crane Critical Lift Plan; G

Crane Work Plan; G

Proof of qualification for Crane Operators; G

SD-06 Test Reports

Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports

Monthly Exposure Reports

Regulatory Citations and Violations

Crane Reports

SD-07 Certificates

Confined Space Entry Permit

Submit one copy of each permit attached to each Daily Quality Control Report.

1.3 DEFINITIONS

a. Associate Safety Professional (ASP). An individual who is currently certified as an ASP by the Board of Certified Safety Professionals.

b. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.

c. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

d. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

e. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

f. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

g. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

h. Qualified Person for Fall Protection. A person with a recognized degree or professional certificate, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

i. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

(1) Death, regardless of the time between the injury and death, or the length of the illness;

(2) Days away from work;

(3) Restricted work;

(4) Transfer to another job;

(5) Medical treatment beyond first aid;

(6) Loss of consciousness; or

(7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

j. Site Safety and Health Officer (SSHO). The superintendent or other qualified or competent person who is responsible for the on-site safety and health required for the project. The Contractor quality control (QC) person can be the SSHO on this project.

k. Steep roof. A roof having a slope greater than 4 in 12 (vertical to horizontal).

l. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

m. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following federal, state, and local, laws, ordinances, criteria, rules and regulations . Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall meet the following requirements:

Level 4:
A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.
30-hour OSHA construction safety class or equivalent within the last 5 years.
An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following 3 areas of competency: Excavation; Scaffolding; Fall protection.

1.6.1.2 Associate Safety professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST)...

Provide a/an Associate Safety Professional (ASP) at the work site to perform safety management, surveillance, inspections, and safety enforcement for the Contractor. The ASP shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The ASP shall be at the work site at all times whenever work or testing is being performed and shall conduct and document daily safety inspections. The ASP shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

1.6.1.3 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacitates of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or and organization that tests and qualifies crane operators). Proof of current qualification shall be provided.

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)/Superintendent

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.

b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6.2.2 Associate Safety Professional (ASP)

a. Perform safety and occupational health management, surveillance, inspections, and safety enforcement for the project.

b. Perform as the safety and occupational health "competent person" as defined by USACE EM 385-1-1.

c. Be on-site at least weekly whenever work or testing is being performed.

d. Conduct and document safety inspections.

e. Shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

If the ASP is appointed as the SSHO all duties of that position shall also be performed.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's Accident Prevention Plan (APP) before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent,

site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

e. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.6.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.6.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

1.7 TRAINING

1.7.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.7.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.7.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.8 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described below at paragraph 1.8.1. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any unforeseen hazard become evident during the performance of work, the project superintendent shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the resident engineer's office and at the job site.
The APP shall be continuously reviewed and amended, as necessary,

throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.8.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. The duties of each position shall be specified.

b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and protective actions are instituted to ensure health.

e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.c.18. and the following:

(1) For lifts of personnel, the plan shall demonstrate

compliance with the requirements of 29 CFR 1926.550(g).

(2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.

f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m (6 feet). A qualified person for fall protection shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project. The Fall Protection and Prevention Plan shall be included in the Accident Prevention Plan (APP).

h. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, confined space entry, fall protection, crane operation, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

i. Excavation Plan. The safety and health aspects prepared in accordance with Section 02300 EARTHWORK. j. Crane Work Plan. The contractor shall provide a crane work plan to the Contracting Officer for acceptance. The crane work plan shall include the specific model of each crane and a drawing identifying their locations (exact), the dimensions, wheel sizes, number of wheels, wheel spacing, tire pressure(s), number of axles, axle spacing, minimum wheel load to be exerted during operations and maximum outrigger load to be exerted during operations. The Contractor shall allow at least 10 working days for acceptance/non-acceptance of the crane work plan. No crane operations shall begin prior to written acceptance of the crane work plan by the Government.

1.9 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15calendar days prior to the start of each phase. Format subsequent AHA as amendments to the APP. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall protection methods used. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an AHA shall not proceed until the AHA has been accepted by the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.10 DISPLAY OF SAFETY INFORMATION

Within 1 calendar day after commencement of work, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

a. Map denoting the route to the nearest emergency care facility.

b. Emergency phone numbers.

c. Copy of the most up-to-date APP.

d. Current AHA(s).

e. OSHA 300A Form.

f. OSHA Safety and Health Protection-On-The-Job Poster.

g. Confined space entry permit.

j. Safety and Health Warning Posters.

1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.12 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.13 REPORTS

1.13.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least $2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

b. For any weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

1.13.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal

to or greater than $2,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.13.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

1.13.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

1.13.5 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

1.14 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.

b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers

located away from the facility.

c. The storage of combustible supplies shall be a safe distance from structures.

d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.

e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.

f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm (one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m (5 feet).

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard shall prevail.

3.1.1 Hazardous Material Use

Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the Station Utilities Department to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and escape procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m(6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.I. and 05.J. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 1.8 m (6 feet) from an edge, warning

lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep Roofs: Work on steep roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.3.4 Safety Nets

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded work places, leading edge work or when working over water, machinery, dangerous operations or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, fall arrest systems or restraint/positioning systems are impractical. Safety nets shall be tested immediately after installation with a drop test of 181.4 kg (400 pounds) dropped from the same elevation a person might fall, and every six months thereafter.

3.3.5 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Exiting horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

3.3.6 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.7 Guardrail Systems

Guardrails shall consist of top and mid-rails, post and toe boards. The top edge height of standard railing must be 42 inches plus or minus 3 inches above the walking/working level. When mid-rails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. Posts shall be placed no more than 8 feet apart (29 CFR 1926.500 and USACE EM 385-1-1).

3.3.8 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan,

and the Accident Prevention Plan (APP).

3.4 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 m (20 feet) in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m (20 feet) in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.4.1 Stilts

The use of stilts for gaining additional height in construction, renovation, repair or maintenance work is prohibited.

3.5 EQUIPMENT

3.5.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.5.2 Weight Handling Equipment

b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

e. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

f. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

k. All employees shall be kept clear of loads about to be lifted and of suspended loads.

l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

m. The Contractor shall use cribbing when performing lifts on outriggers.

n. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

o. A physical barricade must be positioned to prevent personnel from

entering the counterweight swing (tail swing) area of the crane.

p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

q. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

r. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

s. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

3.5.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

3.6 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly. The competent person shall perform soil classification in accordance with 29 CFR 1926.

3.6.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings

made during the utility investigation must be maintained throughout the contract.

3.6.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 0.061 m (2 feet) of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 30.5 m (100 feet) if parallel within 1.5 m (5 feet) of the excavation.

3.6.3 Utilities with Concrete Slabs

Utilities located within concrete slabs or pier decks, bridges, and the like are extremely difficult to identify. The location must be coordinated with station utility departments in addition to a private locating service. Outages on system utilities shall be used in circumstances where concrete chipping, saw cutting, or core drilling is required and utilities are unable to be completely identified.

3.6.4 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.6.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.7 ELECTRICAL

3.7.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified.

Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

3.7.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.8 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

c. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.

d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.

f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

3.9 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.10 HOUSEKEEPING

3.10.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location, however garbage accumulation must be removed each day.

3.10.2 Falling Object Protection

All areas must be barricaded to safeguard employees. When working overhead, Barricade the area below to prevent entry by unauthorized employees. Construction warning tape and signs shall be posted so they are clearly visible from all possible access points. When employees are working overhead all tools and equipment shall be secured so that they will not fall. When using guardrail as falling object protection, all openings shall be small enough to prevent passage of potential falling objects.

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SECTION 01572

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

1.2 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations.

1.3 PROJECT WASTE MANAGEMENT REQUIREMENT

The contractor shall salvage or recycle at least 75 percent(by weight)of the generated construction, demolition and land clearing waste.

1.4 PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and prior to initiating any site preparation work. The plan shall include the following:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation.

c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and temporary storage of wastes.

d. Characterization, including estimated types and quantities, of the waste to be generated.

e. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.

g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Recycling facilities that will be used shall be identified.

h. Identification of materials that cannot be recycled/reused with an explanation or justification.

i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

1.5 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction. As necessary, Additional records shall be maintained to satisfy requirements for LEED documentatition and submittal.

1.6 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

1.6.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

1.6.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.6.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.7 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.7.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.

1.7.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

1.7.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

-- End of Section --

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SECTION 01670

RECYCLED / RECOVERED MATERIALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

U. S. GREEN BUILDING COUNCIL (USGBC)

LEED-NC GBRS	(2002)(Rev 3/2003) LEED (Leadership in Energy and Environmental Design), Green Building Rating System For New Construction & Major Renovations (Version 2.1)
LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is

specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

1.6 SUSTAINABLE DESIGN(LEED)COORDINATION

Use of EPA listed items may assist the Contractor in attaining the LEED performance standards required by this contract. Coordinate the acquisition, use and documentation of products containing recycled and/or recovered materials with the requirements of LEED-NC GBRS, LEED-NC RG and other specification sections.

-- End of Section --

SECTION 01701

OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-10 Operations and Maintenance Manuals

Mechanical Operations and Maintenance Manuals; G

Electrical Operations and Maintenance Manuals; G

Fire Protection/Security Operations and Maintenace Manuals; G

Architectural/Other Operations and Maintenace Manuals; G

Preliminary O&M Manual and Data

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall provide Operation and Maintenance (O&M) manuals for the complete project as applicable under this contract, including all Contractor furnished and installed equipment, systems and materials, and all Government furnished-Contractor installed equipment, systems and materials. Included herein are requirements for compiling and submitting the O&M data. Additional O&M data requirements are specified in the individual sections of the technical specifications. O & M Manual requirements shall be coordinated with the requirements as stated in the other technical specification sections and shall include listings for spare parts, framed instructions, etc.

3.1.1 PREPARATION

Manual preparation shall be under the direction of an individual or organization that has demonstrated expertise and a minimum of 3 years experience in the preparation of comprehensive and complete O&M manuals. Qualifications shall be submitted for Contracting Officer approval.

3.1.2 FORMAT

3.1.2 O&M data shall be separated into distinct systems. O&M manuals for any particular system shall include narrative and technical descriptions of the interrelations with other systems. This narrative shall include a description on how the system works with notable features of the system,

including normal and abnormal operating conditions. The explanation of the system is to be short and concise with reference to specific manufacturer's equipment manuals for details (see paragraph CONTENT, subparagraph b). If the quantity of material is such that it will not fit within one binder then it shall be divided into volumes, as required (see paragraph Binders).

3.1.3 Six copies of the complete set of manuals shall be provided for each building (as identified by a building number or building description) for multi-building projects. For those multi-building projects where the work is identical in each building, one copy of the manual is required for each building plus six additional copies. For those projects that do not have work in specific buildings, six copies of the manuals are required for the complete project. Any project may have a combination of these requirements to determine the total number of copies required.

3.1.4 The requirement for six copies of the O&M manual shall supersede and replace any requirements for a lesser amount of manuals which may be indicated in some specifications. Each set of manuals shall be tailored for its respective building or facility.

3.1.5 O&M data shall be in English units.

3.2 PRELIMINARY O&M MANUAL AND DATA SUBMITTAL

To establish and assure uniform O&M manual format, the Contractor shall submit two copies of complete set of O & M data without the binders and receive Contracting Officer approval on one (1) of the sets prior to submission of the final bound manuals. Initial O & M Manual data submittal shall be a minimum of 30 days prior to 90 percent project completion.

The Contractor shall also provide two typewritten pages representing the proposed binder marking format as required under Paragraph: Marking and Binding. One page will represent the front cover/spine and the other page will represent the inside of the front cover.

3.2.1 Data submitted for the manual are to be for the specific equipment furnished, and are in addition to that furnished as shop drawings.

3.2.2 The Contracting Officer will require thirty (30) days for review of submitted O&M manual(s) or data. The Contracting Officer will retain one copy of unacceptable O&M manual submittal and return remainder of copies to the Contractor marked "Returned for Correction." If "Returned for Correction." the Contractor shall resubmit the required number of copies of the manual(s) incorporating all comments, prior to substantial completion and/or use and possession. The Contractor may, at his option, update the copy retained by the Government in lieu of providing the added copy.

3.2.3 For equipment or systems requiring personnel training and/or acceptance testing, all O&M data needed for testing shall be approved by the Contracting Officer prior to the scheduling of the training and/or testing. O&Ms in final bound format shall be submitted in a timely manner so all manuals will be approved in the required quantity, prior to the final inspection. Failure to furnish approved, bound manuals in the required quantity by the final inspection may delay the final inspection and will be

cause for the Contracting Officer to hold or adjust the retained percentage in accordance with CONTRACT CLAUSE, PAYMENTS UNDER FIXED PRICE CONSTRUCTION CONTRACTS.

3.2.4 Three of the six completed copies of the final O&M manuals (for each building) shall contain original manufacturer's data. Data in the remaining manuals may be duplicated copies of original data. All data furnished must be of such quality to reproduce clear, legible copies.

3.3 BINDERS

3.3.1 Construction and Assembly

Manuals shall be sliding posts or screw-type aluminum binding posts (three screws) with spine, but only one type shall be used for all manuals. The manuals shall be hardback plastic-covered, cleanable, not over 76 mm thick and designed for 216 mm by 279 mm paper. The hard cover shall be of minimum stiffness equal to 2.03 mm display board or double weight illustration board.

3.3.2 Marking and Binding

As appropriate, systems shall be grouped into four separate categories and bound into four volumes as follows: Mechanical, Electrical, Fire Alarm/Security, and Architectural/General.

Each binder shall have the following information, as a minimum, inscribed on both the spine and cover using an offset or silk screen printing process; "EQUIPMENT OPERATION, MAINTENANCE, AND REPAIR MANUAL;" BUILDING NAME, IDENTIFICATION NUMBER (Building No.), LOCATION, AND DISCIPLINE (MECHANICAL, ELECTRICAL, FIRE ALARM/SECURITY, ARCHITECTURAL/GENERAL). Contractor's name and address as well as the contract title and contract number shall be printed on the inside of the front cover.

3.3.3 Color

Color of binder and printing shall be the option of the Contractor except that; (a) printing color shall contrast with binder color, and (b) colors shall be the same for all manuals.

3.3.4 Content

The O&M manuals shall be structured to address each of the following topics in order for each system. When the topic does not apply to a particular system the topic name will be included in the manual with the words "DOES NOT APPLY."

a. Warning Page: A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

b. Index: Each manual shall have a master index at the front identifying all manuals and volumes and subject matter by system name for each. Following the master index, each manual shall have an index of its enclosures

listing each volume, tab numbers, etc., as necessary to readily refer to a particular operating or maintenance instruction. Rigid tabbed fly leaf sheets shall be provided for each separate product and/or piece of equipment under each system in the manual. For example, if a system includes Air Handling Units 1 through 5, there shall be tab sheets AHU-1, AHU-2, AHU-3, AHU-4 and AHU-5. When a manual is divided into volumes, each volume shall have a master index at its front, followed by an index for the specific volume listing in detail all enclosed instructions for materials, individual pieces of equipment, and systems. All pages shall be numbered with the referenced number included in the index.

c. Description: Narrative and technical descriptions of the system and of the interrelations with other systems.

d. Check List Prior to Start Up: Precautions and prechecks prior to start up of equipment and/or system, including safety devices, monitoring devices and control sequence shall be provided.

e. Start Up and Operation: Step-by-step sequential procedures for start up and normal operation checks for satisfactory operation shall be provided. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the operating instructions and flagged for the attention of the operator. Procedures shall include test, manual or normal, and automatic modes.

f. Shutdown: Procedures for normal and emergency shutdown of equipment and/or systems shall be provided. The instructions shall include any procedures necessary for placing the equipment and/or system on standby or preparing the equipment and/or system for start up at a later time. Procedures shall include test, manual or normal, and automatic modes.

g. Operator Preventive Maintenance, Major Maintenance, and Adjustments: The instructions shall include recommended operator preventive maintenance which would normally be performed by operating personnel and adjustment procedures necessary for normal operation. Schedules shall be provided indicating time frames or operating hours for initiating operator maintenance and adjustments, and including manufacturer's recommended major maintenance requirements. Emergency adjustments shall be included and flagged for operator's attention; the instructions shall also include procedures for emergency repairs that could be performed by operating personnel. These emergency repairs or "trouble-shooting guides" shall be outlined in three columns with the following headings:

Column 1 - Trouble
Column 2 - Probable Cause(s)
Column 3 - Correction

h. Operator Data: The instructions shall include equipment and/or system layouts showing all piping, wiring, breakers, valves, dampers, controls, etc., complete with diagrams, schematics, isometrics, and data to explain the detailed operation and control of each individual piece of equipment and/or system, including system components. Layouts shall show the location within the facility of controls, valves, switches, dampers, etc., by reference to site location, wing designation, floor, room number, or other clear and

concise directions for locating the item. Operator data may be identical to posted data and framed instructions but shall be prepared as part of the O&M manuals. All control systems operations data shall include the following:

(1) A fully labeled control schematic which details all set points, throttling ranges, actions, spans, proportional bands, and any other adjustment.

(2) A fully labeled elementary diagram (ladder diagram).

(3) A sequence of control on the diagrams cross-referenced to the control schematic and elementary diagram.

(4) A generic, functional description of each control component shown on the drawings.

(5) Catalog data of every control device.

i. Electrical Layout Drawings: The Electrical O&M's shall include complete layout drawings and one-line diagrams of exterior and interior electrical with reference to the buildings and site layout. Drawings shall include layout of interior lighting, interior power, intrusion detection systems, communication systems and fire protection systems. Exterior layout drawings shall show where fed from, pad-mount transformer, metering, main distribution panel and communication lines. Layout drawings shall show the location within the facility or reference to the building and the site plan. Layout drawings shall be half size contract as-built drawings and shall be inserted into plastic pockets and installed at the back of the O&M's that pertain to that particular drawing.

j. Maintenance Procedures: Recommended procedures shall indicate preventive maintenance, lubrication, and good housekeeping practices which should be performed by operating personnel as well as more complex maintenance procedures which would normally be performed by trained maintenance personnel only. The procedures shall be presented with a schedule indicating time frames or operating hours for specific maintenance to be accomplished. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the maintenance procedures and flagged for the attention of personnel. The procedures shall include necessary operating instructions for taking equipment off line, putting equipment on line, or putting equipment on standby. The instructions shall include all necessary material, equipment, and system data to perform maintenance work and shall include, but not be limited to, manufacturers/bulletins, catalogs, and descriptive data; certified performance curves, copies of approved test plans, including logs and records of performance acceptance test results, and actual adjustments made during final acceptance and inspection; system layouts, including block diagrams, wiring, control, and isometric diagrams: schematic items within the facility; and interrelationships with other items of system.

k. Repairs: Repair procedures shall be presented with a step-by-step procedure for locating and correcting the trouble. A "shop manual" may be used for this purpose. Repair procedures shall be keyed to a troubleshooting guide outlined in three columns with the following headings:

Column 1 - Trouble
Column 2 - Probable Cause(s)
Column 3 - Correction

The procedures shall clearly indicate a major repair activity which should only be performed in a shop or factory versus normal repair work that may be performed onsite or with equipment online. The procedures shall also clearly indicate the limit of repair work that may be performed by Government personnel during the warranty period without voiding warranty provisions. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the repair procedures and flagged for the attention of personnel.

l. Tools: The Contractor shall provide one of each nonstandard tool, test instrument, and gauge necessary for performing maintenance and repair work. A nonstandard tool, test instrument, or gauge is defined as an item normally supplied by the manufacturer for the equipment operation or maintenance. The Contractor shall prepare a master list of such items for all equipment and systems and shall key maintenance and repair procedures to this list. The above referenced items for performing maintenance and repair work shall be provided for each individual facility of multifacility projects.

m. Parts and Supplies: A complete list of parts and supplies shall be provided with the maintenance instructions. The list shall include all parts and components of individual pieces of equipment, and all parts and components of each system and shall identify such items as description of part, model number, circuit or component identification, etc. Parts and supplies lists shall be included within each volume of maintenance instructions. Further, a master list of spare parts and supplies recommended from each manufacturer for 1 year of operation, including source of supply, shall be sublisted with each instruction.

(1) Availability: The Contractor shall list the sources of supply for all parts and supplies, including name of supplier/manufacturer, address, and telephone number. If the parts and supplies are not normally stocked locally, (within 6 hours travel time, round trip by surface transportation) necessary procurement time shall also be a part of the listing.

(2) Spare Parts: The Contractor shall provide those spare parts and supplies that are specified in the TECHNICAL SPECIFICATIONS and those which are normally provided with the equipment or material item. A separate master list shall be provided for these items upon turnover to the Government of the parts and supplies.

n. Maintenance Schedule: A separate schedule of all required periodic maintenance shall be included. This schedule shall list by frequency of occurrence all lubricants and special adjustments required. The types and amounts of lubrication must be specified. The Contractor shall verify that the furnished maintenance schedule agrees with the published manufacturer's data.

3.3.4.1 Architectural/General O&M:

(1) Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products. Data shall include, but not be limited to, information on carpet, floor tile, vinyl wall finishes, builder's hardware, etc.

(2) Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

(3) Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

(4) Additional Requirements: As specified in individual specifications sections.

3.3.4.2 Warranties:

In addition to the general warranty required by the contract, the O&M manuals shall include any specific warranties required by other sections of the TECHNICAL SPECIFICATIONS and other warranties normally provided with the particular piece of equipment or system. Extended warranties normally provided by manufacturers that are beyond the warranty of construction shall be specifically noted. The O&M manuals shall also include a specific warranty section itemizing all standard and extended warranty items. The warranty list shall be as indicated below. Warranties will not begin until the facility is accepted by the Contracting Officer. Copy of warranty shall be included in the manual.

WARRANTY INFORMATION

Project Title
Contract Number

General Contractors Name, Phone Number

ITEM DESCRIPTION	START DATE	END DATE	O & M REFERENCE LOCATION
(in alphabetical order)			
Descriptive Name, Manufactures/ Warrantors Name Address & Phone No.			

3.3.4.3 Installed Equipment Lists:

A copy of the completed Equipment in Place forms required in Section 01705 EQUIPMENT-IN-PLACE -LIST shall be included in the manual. The completed

forms shall be located at the front of the catalog and O&M data for the equipment listed on the form.

3.3.4.4 Data Layout:

(1) Data Identification: Catalog data shall be marked to clearly identify pertinent data by highlighting the data with pointers or crossing out all nonpertinent data.

(2) Drawings: All drawings bound in the manuals shall be of such size that will require only one fold made right to left. All larger size drawings shall be inserted into a separate pocket in the required location in the manual. All drawings shall be of microfilm quality.

(3) Posted Data: The Contractor shall provide posted data for equipment or systems, in addition to O&M manuals, and as required by other Technical Specifications sections. The data shall consist of as-built schematics of all wiring, controls, piping, etc., as necessary for the operation of the equipment or system, and a condensed typewritten description of the system. The posted data may include approved shop drawings, layout drawings, riser, and block diagrams and shall indicate all necessary interrelation with other equipment and systems. The data may be presented in one or several frames, under glass or sheet acrylic glazing, for clarity and convenience of location. The framed data presentation and outline shall be acceptable to and posted at locations designated by the Contracting Officer. The data shall be posted before personnel training or performance testing acceptance for the related items of equipment or system.

(4) Framed Instructions: Typewritten instructions, framed under glass or sheet acrylic glazing, explaining equipment or system prestart checkout, startup, operations and shutdown procedures, safety precautions, preventive maintenance procedures, and normal operation checks for satisfactory performance of the equipment of systems shall be posted in conjunction with the posted data. The framed instructions may be presented in one or several frames for clarity and convenience of location. The instruction presentation and outline shall be acceptable to the Contracting Officer prior to posting, and shall be posted at locations designated by the Contracting Officer. All framed instructions shall be posted before personnel training or performance testing acceptance commences for the related item of equipment or system.

3.4 CHECKLIST

Contractor shall complete and initial a copy of the O&M Manual Check List which is provided at the end of this section, and forwarded along with ENG form 4025 as part of the O&M Manual submittal to the Contracting Officer for approval.

O&M MANUAL - REVIEW CHECKLIST

___ Does the manual cover all equipment furnished under the contract? (Review against equipment schedules on the drawings and/or equipment submittals.)

___ Does the manual clearly highlight all relevant portions or cross out all irrelevant portions of catalog data?

___ Does the manual contain operations data for the equipment? (Step-by-step operating instructions, start up procedures, sequences of operation, precautions.)

___ Does the manual contain maintenance and repair data for the equipment? (Lubrication, dismantling, assembly, adjustment, troubleshooting.)

___ Does the manual contain a separate maintenance schedule listed by frequency of occurrence?

___ Does the manual contain parts lists or parts catalogs for the equipment? Parts catalog or list shall contain identification, part numbers, recommended parts to be stocked, and local source of parts.

___ Does the manual contain electrical connection diagrams?

___ Does the manual contain control and interlock system diagrams where applicable?

___ Is every page in the manual numbered and an index provided for ready reference to the data?

___ Is the cover hard (nonflexible) with the facility name, identification number, location, and system embossed on both the spine and cover? Is the Contractor's name and address, and the contract title and contract number embossed on the inside of the manual cover?

___ Is the binding screw posts or sliding post?

___ Is any of the data in the manual under the binding where it cannot be seen?

___ Do three sets of manuals contain all original data sheets and are others clearly legible?

___ Are system layout drawings provided? (Simplified diagrams for the system as installed.)

___ Are all drawings in the manual of such a size that requires one fold right to left, or if a larger size drawing, then inserted into a pocket in the manual?

Note that the above are common requirements to all contracts. Check the specific contract for additional information.

-- End of Section --

SECTION 01702

AS BUILT RECORDS AND DRAWINGS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 As-Built Field Data

Red Line Drawings; G

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 AS-BUILT FIELD DATA

3.1.1 General

The Contractor shall keep at the construction site two complete sets of full size prints of the contract drawings, reproduced at Contractor expense, one for the Contractor's use, one for the Government. During construction, both sets of prints shall be marked to show all deviations in actual construction from the contract drawings. The color red shall be used to indicate all additions and green to indicate all deletions. The drawings shall show the following information but not be limited thereto:

a. The locations and description of any utility lines and other installations of any kind or description known to exist within the construction area. The location includes dimensions and/or survey coordinates to permanent features.

b. The locations and dimension of any changes within the building or structure, and the accurate location and dimension of all underground utilities and facilities.

c. Correct grade or alignment of roads, structures, and utilities if any changes were made from contract plans.

d. Correct elevations if changes were made in site grading from the contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including, but not limited to, fabrication erection, installation, and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

f. The topography and grades of all drainage installed or affected as part of the project construction.

g. All changes or modifications from the original design and from the final inspection.

h. Where contract drawings or specifications allow options, only the option actually used in the construction shall be shown on the as-built drawings. The option not used shall be deleted.

These deviations shall be shown in the same general detail utilized in the contract drawings. Marking of the prints shall be pursued continuously during construction to keep them up to date. In addition, the Contractor shall maintain full size marked-up drawings, survey notes, sketches, nameplate data, pricing information, description, and serial numbers of all installed equipment. This information shall be maintained in a current condition at all times until the completion of the work. The resulting field-marked prints and data shall be referred to and marked as "As-Built Field Data," and shall be used for no other purpose. They shall be made available for inspection by the Contracting Officer's representative whenever requested during construction and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. Failure to keep the As-Built Field Data (including Equipment-in-Place lists) current shall be sufficient justification to withhold a retained percentage from the monthly pay estimate.

As-built field data shall be in English units.

3.1.2 Submittal of the As-Built Field Data

Two sets of the full size As-Built Field Data shall be submitted to the Contracting Officer for review and approval a minimum of 20 calendar days prior to the date of final inspection. If review of the preliminary as-built drawings reveals errors and/or omissions, the drawings will be returned to the Contractor for corrections. The Contractor shall make all corrections and return the drawings for backcheck to the Contracting Officer within 10 calendar days of receipt. When submitted drawings are accepted, one set of marked drawings will be returned to the Contractor for the completion of the as-built drawings.

3.2 AS-BUILT ELECTRONIC FILE DRAWINGS

3.2.1 No earlier than 30 days after award the Government will have available for the Contractor one set of MicroStation electronic file format contract drawings, to be used for preparation of as-built drawings. The electronic file drawings will be available on either 89 mm (3-1/2 inch) 1.44 MB floppy disks or ISO-9660 CD-ROM, as directed by the Contracting Officer. The Contractor has 30 days after the receipt of the electronic file to verify the usability of the MicroStation files, and bring any discrepancies to the attention of the Contracting Officer. Any discrepancies will be corrected within 15 days and files returned to the Contractor. The Contractor shall incorporate all deviations from the original contract drawings as recorded in the approved 'As-built Field Data' (see paragraph 3.1.2). The Contractor shall also incorporate all the written modifications to the contract drawings which were issued by amendment or contract modification. All revisions and changes shall be incorporated, i.e. items marked "deleted" shall be deleted, clouds around new items shall be removed, etc.

3.2.2 No later than 30 days after final acceptance a complete set of as-built drawings shall be submitted in MicroStation electronic file format. The electronic file format, layering standards and submittal requirements are specified in paragraphs below. The as-built drawings shall be done in a quality equal to that of the originals. Line work, line weights, lettering, and use of symbols shall be the same as the original line work, line weights, and lettering, and symbols. If additional drawings are required they shall be prepared in electronic file format under the same guidance. When final revisions have been completed, each drawings shall be identified with the words "AS-BUILT" in block letters at least 3/8-inch high placed above the title block if space permits, or if not, below the title block between the border and the trim line. The date of completion and the words "REVISED AS-BUILT" shall be placed in the revision block above the latest revision notation.

3.2.3 Electronic File Submittal Requirements

3.2.3.1 The AutoCAD electronic file(s) deliverable shall be in AutoCAD release 2000'DWG' binary format. All support files required to display or plot the file(s) in the same manner as they were developed shall be delivered along with the files. These files include but are not limited to Font files, Menu files, Plotter Setup, and Referenced files. The AutoCad files shall be "bound" (merged). It is the Contractor's responsibility to translate the design Microstation files to AutoCad files for as-built drawings.

3.2.3.1 The MicroStation electronic file(s) deliverable shall be in MicroStation 'DGN' binary format. All support files required to display or plot the file(s) in the same manner as they were developed shall be delivered along with the files. These files include but are not limited to Font Libraries, Pen Tables, and Referenced files.

3.2.3.2 Leveling shall remain as provided in the electronic files. An explanatory list of which levels are used in each drawing, including any additional levels needed to complete incorporation of the As-Built data, shall be provided with each submittal.

3.2.3.3 Electronic File Deliverable Media:

All electronic files shall be submitted in ISO 9660 format CD-ROM (CD). Zip drive disks shall not be provided. Two complete sets of CD(s) shall be submitted along with one complete set of ½ size prints taken from the CD(s). See paragraph 3.2.4 below. Each CD shall have a clearly marked label stating the Contractor's firm name, project name and location, submittal type (AS-BUILT), and date the CD was made. Each submittal shall be accompanied by a hard copy transmittal sheet that contains the above information along with tabulated information about all files submitted, as shown below:

Electronic File Name	Plate Number	Drawing Title

Electronic version of the table shall be included with each submittal set of disks.

3.2.4 Submittal of the Final As-Built Drawings

The final as-built record drawings shall be completed and returned together with the approved preliminary as-built drawings to the COE, Seattle District Office, Technical Branch, Records and Information Section, within 30 calendar days of final acceptance. All drawings from the original contract drawings set shall be included, including the drawings where no changes were made. The Government will review all final as-built record drawings for accuracy and conformance to the drafting standards and other requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The drawings will be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the drawings to the same office within 7 calendar days of receipt.

3.3 All costs incurred by the Contractor in the preparation and furnishing of as-built drawings in electronic file format shall be included in the contract price and no separate payment will be made for this work. Approval and acceptance of the final as-built record drawings shall be accomplished before final payment is made to the Contractor.

3.4 As Built Prints

One set of marked-up as-built prints shall be furnished at the time of system acceptance testing. These as-built prints shall be in addition to the submittals of marked-up as-built prints specified elsewhere in the contract.

-- End of Section --

SECTION 01703

WARRANTY OF CONSTRUCTION

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Warranty Management Plan; G

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, e-mail address and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags; G

Two record copies of the warranty tags showing the layout and design.

1.2 WARRANTY MANAGEMENT

1.2.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in SECTION 00700, CONTRACT CLAUSES. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. Information to be turned over to a privatized

Utility Contractor shall be separately bound. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact, telephone numbers and e-mail addresses within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses, e-mail addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.
8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
10. Cross-reference to specific pertinent Operation and Maintenance manuals.
11. Organization, names, 24-hour emergency phone numbers and e-mail addresses of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.2.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the

construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification by the Contracting Officer or his representative of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.2.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number, e-mail address and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact shall be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this contract.

NOTE: Local service area is defined as the area in which the Contractor or his representative can meet the response times as described in paragraph 1.2.4 below and in any event shall not exceed 200 miles radius of the construction site.

1.2.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Government or utility owner, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the

warranty period within two working days of repair completion. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. Interim status reports shall be submitted weekly on repairs that have not yet been completed. If the Contractor does not perform the construction warranty work within the timeframes specified, the Government will perform the work and backcharge the Contractor.

a. First Priority Code 1 - Safety/Life & Health/Emergency: Perform onsite inspection to evaluate situation and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2 - Property Damage/Severe Inconvenience/Urgent: Perform onsite inspection to evaluate situation and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows (the applicable priority will be determined by the Government in its sole discretion):

Code 1-Air Conditioning Systems
(1) Recreational support.
(2) Air conditioning leak in part of building, if causing damage.
(3) Air conditioning system not cooling properly.

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors
(4) Traffic signal blackout

Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights, exit lights or emergency lights (in a room or part of building).
(3) Traffic signal inoperable (flashing)

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
(1) Area power failure affecting heat.
(2) Heater in unit not working.

Code 2-Kitchen Equipment
(1) Dishwasher not operating properly.
(2) Any other equipment hampering preparation of a meal.

Code 1-Plumbing
(1) Hot water heater failure.
(2) Leaking water supply pipes.
(3) Fire sprinkler systems

Code 2-Plumbing
(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3 -Plumbing
Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
Temporary repairs shall be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 1-Water (Exterior)
(1) No water to a building with sanitary facilities.
(2) Broken water main.

Code 2-Water (Exterior)
No water to facility.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 1 - Sewerage

(1) Sewage line backup.
(2) Broken sanitary or storm sewer main

Code 3-All other work not listed above.

1.2.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

a. Type of product/material _____.

b. Model number _____.

c. Serial number_____.

d. Contract number_____.

e. Warranty period _____from _____to _____.

f. Contractor Inspector's (QC) signature _____.

g. Construction Contractor _____.

Address_____.

Telephone number_____.

E-mail address _____.

h. Warranty contact_____.

Address_____.

Telephone number_____.

E-mail address _____.

i. Warranty response time priority code_____.

PART 2 (NOT APPLICABLE)

PART 3 (NOT APPLICABLE)

-- End of Section --

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SECTION 01704

FORM 1354 CHECKLIST

PART 1 GENERAL

1.1 Procedures

The form which is a part of this specification section shall be completed for any project having revisions to real property. The following page contains the basic instructions applicable to the form.

1.2 Submittal

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-11 Closeout Submittals; G

Form 1354 shall be submitted for approval, and be approved a minimum of 30 days before final inspection of the project. Failure to have this form completed and approved in time for the final inspection will result in delay of the inspection until the checklist is completed.

PART 2 NOT USED

PART 3 NOT USED

INSTRUCTIONS FOR DD FORM 1354 CHECKLIST

The following checklist is only a guide to describe various parts of new and modified construction. Alter this form as necessary or create your own document to give complete accounting of the real property added or deleted for this contract. All items added, deleted, replaced, or relocated within the building 5 foot line, or on site 5 feet beyond the building perimeter must be accounted for completely. Only a few of the most common items beyond the 5 foot line are included on the checklist under UTILITIES/SURFACE CONSTRUCTION, add additional items as required by the construction accomplished.. Attach a continuation sheet and use the checklist format to describe other work related to this particular project. Listed on the last page are additional items with units of measure and descriptive terms.

Costs for each item must include material, tax, installation, overhead and profit, bond and insurance costs. This form should be filled out as each item is installed or each phase of work is completed.

TOTAL FOR ALL ITEMS INCLUDING CONTRACT MODIFICATION COSTS ADDED TOGETHER SHOULD EQUAL THE TOTAL CONTRACT PRICE.

NOTE: USE ENGLISH UNITS OF MEASURE, even if project is designed in metric units.

KEY TO ABBREVIATIONS

AC Acres
BL Barrels, Capacity
BTU British Thermal Unit
CY Cubic Yards
EA Each
GA Gallons, Capacity
HD Head
kV Kilovolt-Amperes, Capacity (kVA)
kW Kilowatts, Capacity
SE Seats
SF Square Feet
SY Square Yard
MB Million British Thermal Units
MI Miles
LF Linear Feet
KG Thousand Gallons Per Day, Capacity
TN Ton
- Number; How Many

DD FORM 1354 CHECKLIST
Transfer of Real Property

CONTRACT NUMBER:_____

CONTRACT TITLE:_____

LOCATION:_____

1. DEMOLITION (Describe each item removed and the cost of removal.)*

2. RELOCATION (Describe each item relocated and the cost of relocation.)*

3. REPLACEMENTS (Describe each item replaced and replacement cost.)*

*Use a continuation sheet if more space is required. Items should be described
by quantity and the correct unit of measure.

4. NEW CONSTRUCTION OVERVIEW: BUILDING(S)/ADDITION(S) TO A BUILDING - Use a separate checklist for each building and/or addition.

(1) Outside Dimensions: Length x Width

(a) Main Building_____
(b) Offsets_____
(c) Wings_____
(d) Basement_____

(e) Attic_____

(2) Number of Usable Floors: _____

(3) Construction: Exterior Materials Used

(a) Foundation (such as concrete)_____
(b) Floors (such as wood, concrete)_____
(c) Walls (such as wood siding, metal, CMU)_____
(d) Roof (such as metal, comp., built-up)_____

(4) Utilities ENTERING Building: Measure lineal feet from building entry to next larger
size of pipe

(a) Water (size & type of pipe; number of lineal feet_____
(b) Gas (size & type of pipe; number of lineal feet_____
(c) Sewer (size & type of pipe; number of lineal feet_____
(d) Electric (phase, voltage, size & type of wire, connected load in amps_____

(5) Air Conditioning:

(a) Type_____
(b) Capacity Kilograms (TONS)_____
(c) SQ YARDS covered by system_____

(6) Heating:

(a) Source_____
(b) Fuel_____

(7) Hot Water Facilities:

(a) Capacity Liters (GAL)_____
(b) Temperature Rise_____

BUILDING COST:_____

5. BUILDING SYSTEMS (INTERIOR)

A. FIRE PROTECTION:
Property Code
(1) (880 50/880-211) CLOSED HEAD AUTO SPRINKLERS - Square Feet & HD (wet or dry pipe; # of Lineal Feet of service pipe; type of pipe & # of heads; # of Square Feet covered by system)
DESCRIPTION:
_____
_____
_____
COST: _____

(2) (880 50/880-212) OPEN HEAD DELUGE SYSTEM - Square Feet & HD (# of Lineal Feet of service pipe; type of pipe; # of heads; # of Square Feet covered)
DESCRIPTION:
_____
_____
_____
COST: _____

(3) (880 10/880-221) AUTO FIRE DETECTION SYSTEM - Square Feet & EA (# of alarms-horns, bells, etc.; # of smoke detectors; # of heat detectors; # of fire alarm panels;
# of radio transmitters/antennae)
DESCRIPTION:
_____
_____
_____
COST: _____

(4) (880 20/880-222) MANUAL FIRE ALARM SYSTEM - EA (# of pull stations; # of alarm horns; # of fire extinguisher cabinets)
DESCRIPTION:
_____
_____
_____
COST: _____

(5) (880 60/880-231) CO2 FIRE SYSTEM (# of bottles & size of bottles in kilograms (lbs.))
DESCRIPTION:
_____
_____
_____
COST: _____

(6) (880 60/880-232) FOAM FIRE SYSTEM - EA (# of tanks - capacity in kilograms (lbs.))
DESCRIPTION:
_____
_____
_____
COST: _____

(7) (880 60/880-233) OTHER FIRE SYSTEM - EA
DESCRIPTION:
_____
_____
_____
COST: _____

(8) (880 60/880-234) HALON 1301 FIRE SYSTEM - EA (# of bottles & size of bottles in kilograms (lbs.))
DESCRIPTION:
_____
_____
_____
COST: _____

B. SECURITY:

(1) (880 40/872-841) SECURITY ALARM SYSTEM - EA (name of system installed)
DESCRIPTION:
_____
_____
_____
COST: _____

C. HEATING/COOLING SYSTEMS

(1) (826 10/890-126) A/C WINDOW UNITS - kilograms (TN) & Square Feet-(# of units installed; amount of Square Feet covered per unit; size & capacity of each unit)
DESCRIPTION:
_____
_____
_____
COST: _____

(2) (826 14/890-125) A/C PLT LESS THAN 4,536 kilograms (5 TN) kilograms (TN) & square feet-(# of kilograms (TN); # of square feet covered)
DESCRIPTION:
_____
_____
COST: _____

(3) (826 13/890-121) A/C PLT 4,536 to 22,680 kilograms (5 TO 25 TN) kilograms (TN)-(# of kilograms (TN); # of square feet covered)
DESCRIPTION:
_____
_____
_____
COST: _____

(4) (826 12/826-122) A/C PLT 22,680 to 2,267,962 kilograms (25 TO 100 TN) - kilograms (TN)-(# of kilograms (TN); # of square feet covered)
DESCRIPTION:
_____
_____
_____
COST: _____

(5) (826 11/826-123) A/C PLT OVER 2,267,962 kilograms (100 TN) kilograms (TN)-(# of kilograms (TN); # of square feet covered)
DESCRIPTION:
_____
_____
_____
COST: _____

(6) (821 33/821-115) HEATING PLT 220/1026 W (750/3500 MB) - W (MB)-(# of kW (MBH); type of heating system Ex: Warm air furnace, central)
DESCRIPTION:
_____
_____
_____
COST: _____

(7) (821 32/821-116) HEATING PLT OVER 1026 W (3500 MB) - W(MB)-(# of kW (MBH); type of heating system)
DESCRIPTION:
_____
_____
COST: _____

(8) (811 60/811-147) ELEC EMERGENCY POWER GENERATOR-KW-(size of engine; rating of generator in kilowatts & voltage)
DESCRIPTION:
_____
_____
_____
COST: _____

(9) (81190 or 82320-gas) STORAGE TANK FOR HEATING or GENERATOR FUEL Liters (GA); TYPE; FUEL (Size, type of tank, kind of fuel & # of liters (gallons))
DESCRIPTION:
_____
_____
_____
COST: _____

(10) (89220/890-272) EMCS - EA (Direct Digital Control Sys)
_____
_____
_____
COST: _____

SITE WORK

6. UTILITIES/SURFACE CONSTRUCTION:

(1) (812 41/812-223) PRIM DISTR LINE OH Lineal Feet (# Lineal Feet of wire; size & type of wire; # of poles; voltage)
DESCRIPTION:
_____

_____
_____
COST: _____

(2) (812/81360) TRANSFORMERS KVA
POWER POLES Lineal Feet
(# poles; # transformers - pad or pole mounted; kVA of wire; # Lineal Feet of wire)
DESCRIPTION:
_____
_____
_____
COST: _____

(3) (812 40/812-224) SEC DISTR LINE OH Lineal Feet (voltage; size & type of wire;
transformers; kVA; # Lineal Feet of wire; # of service drops; # poles)
DESCRIPTION:
_____
_____
_____
COST: _____

(4) (812 42/812-225) PRIM DISTR LINE UG Lineal Feet (kVA; voltage; type of conduit &
size(encased or direct burial); size & kind of wire inside conduit; Lineal Feet of wire & conduit)
DESCRIPTION:
_____
_____
_____
COST: _____

(5) (812 42/812-226) SEC DISTR LINE UG Lineal Feet (type of conduit & size; type & size
of wires in conduit; Lineal Feet of conduit & wire inside conduit; voltage)
DESCRIPTION:
_____
_____
_____
COST: _____

(6) (812 30/812-926) EXTERIOR LIGHTING EA (streets or parking area lights) (#
& type of lights; whether pole mounted or not; # Lineal Feet of connecting wire if pole
mounted)
DESCRIPTION:
_____
_____
_____
COST: _____

(7) (824 10/824-464) GAS MAINS Lineal Feet (size, type, & # of Lineal Feet of pipe)
DESCRIPTION:
_____
_____
_____
COST: _____

(8) (831 90/831-169) SEWAGE SEPTIC TANK thousand liters (KG) (size, kind of material, & capacity)
DESCRIPTION:
_____
_____
_____
COST: _____

(9) (832 10/832-266) SANITARY SEWER Lineal Feet (sizes & types of pipes # of Lineal Feet of each; # of cleanouts; # & size of manholes)
DESCRIPTION:
_____
_____
_____
COST: _____

(10) (842 10/842-245) WATER DISTR MAINS (POTABLE) Lineal Feet (# Lineal Feet & size, type of pipe)
DESCRIPTION:
_____
_____
_____
COST: _____

(11) (843 11/843-315) FIRE HYDRANTS EA-(#; size & type)
DESCRIPTION:
_____
_____
_____
COST: _____

(12) (851 90/851-143) CURBS & GUTTERS Lineal Feet (# Lineal Feet; material; width & height)
DESCRIPTION: (Is curb extruded or standard)_
_____
_____
_____
COST: _____

(13) (851 90/851-145) DRIVEWAY Square Yards Square Yards; material used; thickness)
DESCRIPTION:
_____
_____
_____
COST: _____

(14) (851 10/12/851-147) ROAD Square Yards & Lineal Feet Square Yards; material used; thickness; Lineal Feet)
DESCRIPTION:
_____
_____
_____
COST: _____

(15) (85210/11 /852-262) VEHICLE PARKING Square Yards-Square Yards; material used; thickness; # of bollards; # of wheel stops; # of regular parking spaces; # of handicap spaces)
DESCRIPTION:
_____
_____
_____
COST: _____

(16) (852 20/852-289) SIDEWALKS Square Yards & Lineal Feet (# Square Feet & Lineal Feet; dimensions of each section & location; thickness; material used)
DESCRIPTION:
_____
_____
_____
COST: _____

(17) (871 10/871-183) STORM DRAIN DISPOSAL Lineal Feet (# Lineal Feet of pipe; sizes & types of pipe; # of catch basins & manholes & sizes of each)
DESCRIPTION:
_____
_____
_____
COST: _____

(18) (872 15/872-247) FENCE, SECURITY (ARMS) Lineal Feet (# of Lineal Feet; fence material; # & type of gate(s); # strands of barbed wire on top)
DESCRIPTION:
_____
_____
_____
COST: _____

(19) (87210/12/872-248) FENCE, INTERIOR Lineal Feet (# of Lineal Feet; fence material; # & kind of gate(s)
DESCRIPTION:
_____
_____
_____
COST: _____

(20) (890 70/890-187) UTILITY VAULT(4 or more transformers) Square Feet (# Square Feet; dimensions of vault; # of transformers)
DESCRIPTION:
_____
_____
_____
COST: _____

(21) (135 10/135-583) TEL DUCT FACILITY Lineal Feet (# of Lineal Feet; size & type of conduit; type of wire)
DESCRIPTION:
_____
_____
_____
COST: _____

(22) (135 10/135-586) TEL POLE FACILITY Lineal Feet (# Lineal Feet & type of wire; # of poles)
DESCRIPTION:
_____
_____
_____
COST: _____

7. INSTALLED EQUIPMENT: Furnish an Equipment In Place List. Any price related to equipment should already be included in this checklist.

8. SYSTEMS NOT PREVIOUSLY LISTED: Attach a separate sheet and use the same format to describe the system(s). Example: CATV system, intercom system, or other utilities and surface construction not described on this checklist.

9. ASBESTOS REMOVAL: Furnish a description by building of the number of Lineal Feet of asbestos removed, number of Lineal Feet of reinsulation, number of Square Feet of soil encapsulation, and number and size of tanks, etc., where asbestos was removed. Also, identify buildings by their numbers and use.

10. MAINTENANCE/RENOVATIONS: List by building number and describe all additions and deletions by quantity and the correct unit of measure. Furnish a cost per building.

UTILITIES/SURFACE CONSTRUCTION Listed below are some additional items which may or may not apply to your contract. EACH item installed on site should be listed and priced separately even if not included on this checklist.

(1) IRRIGATION SYSTEM(Lineal Feet of pipe; size & type of pipe; number and type of heads)
(2) UNDERGROUND/ABOVEGROUND STORAGE TANKS(Liters (GA), type of tank; material stored)
(3) (833-354) DUMPSTER ENCLOSURE(Square Feet & dimensions)
(4) (890-152) UNLOADING PAD(Square Yards; material)
(5) SIGNAGE(Dimensions; material)
(6) (12580) CATHODIC PROTECTION(miles; Lineal Feet)
(7) (87270 LIGHTNING PROTECTION Lineal Feet (LF)
(8) (81290) POLE DUCT RISER(Lineal Feet (LF, type of material)
(9) RAMPS Square Feet, material; Cubic Yards if concrete use code for sidewalk if concrete)
(10) (89080/890-158) LOAD AND UNLOAD PLATFORM Square Feet
(11) (83240/832-255) INDUSTRIAL WASTE MAIN Lineal Feet
(12) WHEEL STOPS (EA; size & material)
(13) (81350) OUTDOOR INTEGRAL DISTR CTR (kVA)
(14) (45110) OUTDOOR STORAGE AREA Square Feet
(15) (73055/730-275) BUS/WAIT SHELTER Square Feet
(16) (690-432) FLAGPOLE (EA; dimensions)
(17) (93210) SITE IMPROVEMENT (JOB)
(18) (93220) LANDSCAPE PLANTING (Hectare (Acre); EA; Square Feet)
(19) (93230) LANDSCAPE BERMS/MOUNDS Square Yards
(20) (93410) CUT AND FILL Cubic Yards
(21) (843-315) FIRE HYDRANTS (EA; Type)
(22) (14970) LOADING AND UNLOADING DOCKS AND RAMPS (not connected to a building) Square Feet (23) BICYCLE RACK (EA)
(24) (85140/812-928) TRAFFIC SIGNALS (EA)
(25) (87210) FENCING OR WALLS Lineal Feet
(26) (15432) RIPRAP Lineal Feet & Square Feet
(27) (75061) GRANDSTAND OR BLEACHERS (EA; SE)
(28) 87150/871-187) RETAINING WALLS Lineal Feet; Square Yards; material

NOTE: 5 Digit Codes Army; 6 Digit Codes Air Force
-- End of Section --

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SECTION 01705

INSTALLED BUILDING EQUIPMENT (REAL PROPERTY) AND EQUIPMENT-IN-PLACE LIST (PERSONAL PROPERTY)

PART 1 GENERAL

1.1 SUBMITTALS

Data listed in PART 3 of this section shall be submitted in accordance with section 01330 SUBMITTAL PROCEDURES. Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 Submittal

The final equipment lists shall be completed as two separate lists if both are required and returned to the Contracting Officer within 45 calendar days prior to the final inspection. The Contracting Officer will review all final equipment lists for accuracy and conformance to the requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The lists shall be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the lists to the Contracting Officer within 7 calendar days of receipt.

3.2 INSTALLED BUILDING EQUIPMENT LIST

Contractor shall submit for approval, at the completion of construction, a list of installed building equipment. Installed building equipment (IBE) consists of items of equipment affixed and built into the facility as an integral part of the facility. It is equipment which supports the functionality of the building. This list shall be updated and kept current throughout construction, and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. A sample form showing minimum data required is provided at the end of this section. The INSTALLED BUILDING EQUIPMENT LIST shall be comprised of all equipment falling under one or more of the following classifications:

a. Each piece of equipment listed on the mechanical equipment schedules.
b. Each electrical panel, switchboard, and MCC panel.
c. Each transformer.
d. Each piece of equipment that contains a manufacturer's serial number on the name plate.
e. All Government furnished, Contractor installed equipment per a.

through d. (price data excluded)

Other examples of installed building equipment are listed on 1705-5.

3.3 EQUIPMENT-IN-PLACE LIST (EIP)

Contractor shall submit for approval, at completion of construction, a list of equipment-in-place. Equipment -in-place consists of capital equipment and other non-expendable supplies of personal property which are mission essential. Equipment-in-place is not real property and may be of a movable nature or affixed to real property, but removable without destroying or reducing the usefulness of the facility. This list shall be updated and kept current throughout construction, and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate if equipment-in-place is included in the construction contract. A sample form showing minimum data required is provided at the end of this section. See list on 01705-6 for items designated equipment-in-place.

INSTALLED BUILDING EQUIPMENT (IBE) (REAL PROPERTY)

CONTRACT NO.: _____

Specification Section:_____ Paragraph No. _____

ITEM DESCRIPTION: _____

Item Name: _____

Serial Number: _____

Model Number: _____

Capacity: _____Replacement Cost _____

ITEM LOCATION:

Building Number: _____ Room Number: _____

or Column Location: _____

MANUFACTURER INFORMATION:

Manufacturer Name: _____

Trade Name (if different from item name):
_____

Manufacturer's Address:
_____

_____

Telephone Number: _____

WARRANTY PERIOD: _____

CHECKED BY: _____

EQUIPMENT-IN-PLACE LIST (MISSION SUPPORT PERSONAL PROPERTY)

CONTRACT NO.: _____

Specification Section: _____ Paragraph No. _____

ITEM DESCRIPTION: _____

Item Name: _____

Serial Number: _____

Model Number: _____

Capacity: _____Replacement Cost _____

ITEM LOCATION:

Building Number: _____ Room Number: _____

or Column Location: _____

MANUFACTURER INFORMATION:

Manufacturer Name: _____

Trade Name (if
different from item name):
_____

Manufacturer's Address:
_____

_____

Telephone Number: _____

WARRANTY PERIOD: _____

CHECKED BY: _____

INSTALLED BUILDING EQUIPMENT

a. Antenna (master antennas for non-paid subscriber entertainment television systems
b. Bedside headwall units conveyors
c. Bleachers (built-in) handling systems
d. Benches (built-in)
e. Boilers
f. Bookcases
g. Cabinets (built-in)
h. Carpet (wall to wall)
i. Chapel seating, baptisteries, altars, pulpits, communion rails and tables, etc. (built-in)
j. Closets
k. Correctional facility equipment
l. Desks and tables (built-in)
m. Dishwasher equipment (built-in)
n. Drinking water coolers (built-in)
o. Electrical components (built-in)
p. Elevators and elevator doors
q. Escalators
r. Exhaust systems
s. Fire Alarm and detection system
t. Food service equipment (built-in)
u. Gas fittings
v. Hardware and fixtures for handicapped access
w. Heating, ventilating, and air conditioning and control systems
x. Hoists (crane and crane rails)
y. Incinerators
z. Key control systems
aa. Laboratory sinks, tables, and benche (built-in)
bb. Lockers (built-in)
cc. Meat cutting equipment
dd. Medical gas systems
ee. Medical automated box
ff. Medical material
gg. Nurse call systems
hh. Paging systems
ii. {Panel; boards
jj. Plumbing
kk. Pneumatic tube systems
ll. Pot and pan washing equipment
mm. Protective construction features
nn. Refrigeration equipment (built-in)
oo. Storm sash and doors
pp. Screens
qq. Shelving and racks (built-in)
rr. Signage
ss. Sprinklers
tt. Sterilizers (built-in)
uu. Storage bins (built-in)
vv. Telecommunication systems
ww. Theater & auditorium railings
xx. Theater stage & fire curtain
yy. Traffic railings
zz. Utility monitoring & control systems
aaa. Vaults
bbb. Wardrobes
ccc. Wardrobes
ddd. Waste disposers

EQUIPMENT-IN-PLACE

PERSONAL PROPERTY (FIXED):

a. Air raid alarm system
b. Bleachers (portable)
c. Closed circuit television system
d. Conveyor systems
e. Electronic repair laboratory & shop equip
f. Electronic security equipment
g. Fixed navigational aids
h. Fixed target range system
i. Intrusion alarm system
j. Laundry equipment
k. Lightening protection system
l. Medical and dental equipment
m. Organs
l. Wall clocks
n. Paint sprayers
o. Photographic equipment
p. Printing presses/related equipment
q. Scientific measuring instruments
r. Steam cleaning equipment
s. Telescopes
t. Testing equipment
u. Training equipment and simulators
v. Vats
w. Wash tanks
x. Watch reporting system
y. Welding machines
z. Woodworking equipment

PERSONAL PROPERTY (MOVABLE):

a. Automated data processing equipment
b. Dental chairs and pedestal units
c. Filing cabinets and portable safes
d. Food service equipment (portable)
e. Furnishings, including rugs
f. Furniture (chairs, tables, beds, desks, and partitions)
g. Office machines
h. Photographic equipment (portable)
i. Pre-wired workstations
j. Shop equipment
k. Training aids/equip, including simulators

-- End of Section --

SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible (in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, if applicable; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Demolition plan; G

Notifications; G.

Submit proposed salvage, demolition and removal procedures to

the Contracting Officer for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts or bills of laden, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the State's environmental protection agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61-SUBPART M.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal

work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 1.8 m (6 foot) high fence. The fence shall be securely erected at the dripline or Critical Root Zone (CRZ) of each individual tree or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer. The dripline is defined as a circle drawn on the ground directly under the trees outmost branches.

1.6.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, of lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.6.5 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted

1.8 FOREIGN OBJECT DAMAGE (FOD)(NOT APPLICABLE)

A

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved

by the Contracting Officer.

1.10 REQUIRED DATA

Demolition plan shall include procedures forcareful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. The procedures shall provide for safe conduct of the work in accordance with EM 385-1-1.

1.11 ENVIRONMENTAL PROTECTION

The work shall comply with the requirements of Section 01355 ENVIRONMENTAL PROTECTION.

1.12 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.13 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the direction of the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

Existing structures indicated shall be totally removed . Basement slabs shall be broken up to permit drainage. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.1.2 Utilities and Related Equipment

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated to full depth . Provide neat sawcuts at limits of pavement removal as indicated.

3.2 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 2300 EARTHWORK

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.3.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the designated disposal area as shown and directed. Three disposal areas are designated to recieve materials as directed:

1)Sequalitchew Creek ECOPARK (Fort Lewis Landfill): Concrete; Asphalt; Masonry and CMU block; topsoil; land clearing debris; clean wood debris(non painted, non treated); stumps(preferred chipped prior to disposal).

2)Sequalitchew Borrow Source Pit: clean excess satisfactory materials; land clearing debris; asphalt; concrete.

3)Lincoln Borrow Source Pit: clean excess satisfactory materials; land clearing debris; asphalt; concrete.

Coordination for disposal of materials shall be with the Contracting Officer and the Fort Lewis Solid Waste and Recycling Manager (Ron Norton, phone 253 966-6452). Asphalt and concrete shall be kept separate for disposal. Masonry and CMU block may be mixed with concrete debris. All other materials not indicated to be accepted in the designated disposal areas shall be disposed of outside the limits of Government-controlled land..

3.4 CLEANUP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION 02231

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2001) Arboricultural Operations - Safety Requirments for Pruning, Repairing, Maintaining, and Removing Trees and Cutting Brush

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials other than Salable Timber; Information only,

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

SD-04 Samples

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS(NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require in accordance with Section 01355 ENVIRONMENTAL PROTECTION and 02220 DEMOLITION.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees to remain shall have all flagging, paint, hardware, or other man-made products removed prior to new exterior plant material installation.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 PRUNING

Existing trees to remain shall be crown-pruned to remove all dead, broken, or hazardous branches. No tree wound dressing or paint shall be used on pruning cuts. Trees located along roads that have overhanging branches shall be pruned to provide vehicle clearance fifteen (15) feet above the ground. Pruning shall be accomplished by a certified arborist

(International Society of Arborists-ISA certified)in accordance with ANSI A300 and ANSI Z133.1. Trees not pruned in accordance to ANSI A300 that suffer damage shall be subject to penalties as described in 01355 Environmental Protection.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 75 mm in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 455 mm below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground. Depressions shall be filled in accordance with SECTION: 02300, EARTHWORK.

3.6 DISPOSAL OF MATERIALS

3.6.1 Saleable Timber

3.6.1.1 Salable Timber: Forest products cut on construction sites shall be classified as Sawlogs, Fuelwood, and Trash. Sawlogs and Fuelwood shall be yarded as described below. Trash shall become property of the Contractor.

3.6.1.2 Sawlogs are made from trees that are 200 mm (8 inches) Diameter Breast Height (DBH) (1350 mm (4?1/2 Feet) above ground level) and larger. Cleanly limb trees flush with tree trunk and top at 150 mm (6?inch) Diameter Inside Bark (DIB). The minimum size for a saw log is 150mm (6-inches) diameter on the small end and 4.8M (16-feet) in length.

3.6.1.2.1 If log cannot be handled in one length, buck one or more 9.6 meters (32 foot) logs, plus standard trim allowance 300mm (12-inches), from the butt until the remainder of the tree is less than 9.6 meters (32 feet) in length.

3.6.1.3 Fuelwood is made from trees smaller than 200 mm (8 inches) DBH, and the tops of trees used for sawlogs. Limb tree, or top, and top at 50 mm (2 inches) DIB. The minimum size for a fuel wood log is 125mm (5-inches) diameter on the large end and 2.4M (8-feet) in length.

3.6.1.4 Trash shall be any forest product not classified as sawlogs or fuelwood.

3.6.1.5 Disposition: Yard sawlogs and fuelwood to a local area, as directed by CO, that does not interfere with the construction project and will be accessible at a later date for salvage disposal action. Deck sawlogs and fuelwood separately. All decks, sawlogs, and fuelwood shall be kept free of limbs and other debris. Trash shall be disposed of in accordance with the following paragraph.

3.6.2 Materials Other than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of in the designated disposal area as shown and directed. Three disposal areas are designated to recieve materials as directed.

1) Sequalitchew Creek ECOPARK (Fort Lewis Landfill): Concrete; Asphalt; Masonry and CMU block; topsoil; land clearing debris; clean wood debris(non painted, non treated); stumps(preferred chipped prior to disposal).

2) Sequalitchew Borrow Source Pit: clean excess satisfactory materials; land clearing debris; asphalt; concrete.

3) Lincoln Borrow Source Pit: clean excess satisfactory materials; land clearing debris; asphalt; concrete.

Coordination for disposal shall be with the Contracting Officer and the Fort Lewis Solid Waste and Recycling Manager(Ron Norton, 253 966-6452). Asphalt and concrete shall be kept separate for disposal. Masonry and CMU block may be mixed with concrete debris. All other materials not indicated to be accepted in the designated disposal areas shall be disposed of outside the limits of Government-controlled land.

-- End of Section --

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop
AASHTO T 224	(2001) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1140	(2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 422	(1963; R 2002) Particle-Size Analysis of

	Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, SW, SP, SW-SM, SP-SM, . Black, organic-rich silty materials (GM and OL) shall be satisfactory for backfill in open, seeded, or turfed areas only provided they contain moisture contents suitable for the intended use. Satisfactory materials for grading shall be comprised of stones less than 150 mm , except for fill material for pavements which shall be comprised of stones less than 75 mm in any dimension. Satisfactory materials for backfill in pervious pavement areas shall comprise of any materials classified by ASTM D 2487 as GW or GP.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials. Black, organic-rich silty materials (GM and OL) are unsatisfactory for building foundation and pavement subgrades and shall be removed as specified in paragraph GENERAL EXCAVATION.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 9.0 mm sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 9.0 mm sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.2.5 Topsoil

Material suitable for topsoils obtained from offsite areas is defined in SECTION: 02921, SEEDING.

1.2.6 Hard/Unyielding Materials

Unyielding material shall consist of gravelly soils with stones greater than 75 mm in any direction or as defined by the pipe manufacturer, whichever is smaller.

1.2.7 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.8 Select Granular Material

1.2.8.1 General Requirements

Select granular material shall consist of materials classified as GW, GP, SW, SP, or by ASTM D 2487 where indicated.

1.2.8.2 California Bearing Ratio Values(NOT APPLICABLE)

1.2.9 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 50 mm or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 25 mm in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring; G,

Dewatering Work Plan; G,

Submit 15 days prior to starting work.

SD-03 Product Data

Utilization of Excavated Materials; G,
Shoulder Construction

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing
Borrow Site Testing

Within 24 hours of conclusion of physical tests, 2 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the commercial testing laboratory.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings . These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1 BLASTING

Blasting will not be permitted.

1.6 DEWATERING WORK PLAN

Submit procedures for accomplishing dewatering work.

PART 2 PRODUCTS

2.1 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Red	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

2.1.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.08 mm . Tape shall have a minimum strength of 10.3 MPa lengthwise, and 8.6 MPa crosswise, with a maximum 350 percent elongation.

2.1.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.10 mm . Tape shall have a minimum strength of 10.3 MPa lengthwise and 8.6 MPa crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.3 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier as shown on the drawings to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall have a maximum particle size of 37.5 mm and no more than 2 percent by weight passing the 4.75 mm size sieve .

2.4 PIPE CASING

2.4.1 Casing Pipe

ASTM A 139, Grade B, or ASTM A 252, Grade 2, smooth wall pipe. Casing size shall be of the outside diameter and wall thickness indicated. Protective coating is not required on casing pipe.

2.5 Bedding Material

Consisting of sand, gravel, or crushed rock, well graded, with a maximum

particle size of 25 mm, 40 to 80 percent by weight passing the 4.75 mm (No. 4) sieve size, and 8 to 20 percent by weight passing the 75 micrometer (No. 200) sieve size, or as recommended by the utility pipe manufacturer. Material shall be composed of tough, durable particles. Fines passing the 75 micrometers standard sieve shall have a plasticity index less than six.

2.6 Rock Spalls

Rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Rock spalls shall be as defined in SECTION: 02630, STORM DRAINAGE. The inclusion of more than trace quantities of dirt, sand, clay, and rock fines will not be permitted.

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. All unsatisfactory materials shall be removed under buildings and structures with footings. Under paved areas, unsatisfactory materials shall be removed up to a maximum depth of 750 mm measured from the top of the subgrade. Approximate limits of unsatisfactory materials are shown on the exploration logs. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in the designated disposal areas as shown and specified in SECTION 02220, Demolition or SECTION 02230, Clearing and Grubbing.. Unsatisfactory excavated material shall be disposed of in the designated disposal areas as shown and specified in SECTION 02220, Demolition or SECTION 02231, Clearing and Grubbing. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be obtained from approved off site sources outside the limits of Government-controlled land selected by the Contractor as specified.

3.1.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed,

except that in no case shall material be deposited less than 1 meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.1.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.1.4 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 0.6 m below the working level.

3.1.5 Trench Excavation Requirements

The trench shall be excavated as shown or as recommended by the manufacturer of the pipe to be installed. When trenching in the vicinity of trees, see 01355 Environmental Protection paragraph 3.2.5 Tree Protection. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls

shall be made vertical. Trench walls more than 1.2 meters high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 1.5 meters high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm (24 inches) plus pipe outside diameter (O.D.) for pipes of less than 600 mm (24 inches) inside diameter and shall not exceed 900 mm (36 inches) plus pipe outside diameter for sizes larger than 600 mm (24 inches) inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.5.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 75 millimeters or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 100 millimeters below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.5.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections. Where new utilities cross newly paved areas on Fort Lewis, utility lines shall be jacked or bored unless specifically approved by Fort Lewis and the Contracting Officer to permit open cut excavation. New utility lines that connect to existing utilities under newly paved areas shall be by open cut excavation where jacking, or boring is not possible subject to approval by the Contracting Officer.

3.1.6 Underground Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within 600 mm of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.1.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement.

3.2 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas from approved private source outside the limits of Government-controlled land. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation and subject to rules and regulations of the borrow pit operation.

3.3 SHORING

3.3.1 General Requirements

The Contractor shall submit a Shoring and Sheeting plan for approval 15

days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.4 GRADING AREASS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Stockpiles of satisfactory shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources.

3.5 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed.

3.6 GROUND SURFACE PREPARATION

3.6.1 General Requirements

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm , pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill.

3.6.2 Frozen Material

Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph TESTING.

3.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in the designated disposal areas as shown and specified in SECTION 02220, Demolition or SECTION 02231, Clearing and Grubbing. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in the designated disposal areas as shown and specified in SECTION 02220, Demolition or SECTION 02231, Clearing and Grubbing. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.8 BURIED TAPE AND DETECTION WIRE

3.8.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 300 mm below finished grade; under pavements and slabs, bury tape 150 mm below top of subgrade.

3.8.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.9 BACKFILLING AND COMPACTION

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM DRAINAGE; 02921, SEEDING, and Section 02300 EARTHWORK. Backfilling within the Critical Root Zone (CRZ) as defined in Section

02220, DEMOLITION shall be 150 mm thick as indicated on the drawings and as defined in Section 02921, SEEDING. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9.1 Trench Backfill

Trenches shall be backfilled to the grade shown. Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 150 mm lifts to top of trench or to top of subgrade for pavements. For other areas outside of structures and pavements, place backfill in 150 mm lifts to at least 300 mm above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 225 mm. The trench shall be backfilled to 0.6 meters above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test. The trench shall not be backfilled until all specified tests are performed.

3.9.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.9.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm loose thickness.

3.9.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown and specified. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 300 mm (one foot) above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, type 4 or as recommended by the pipe manufacturer.

3.9.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Roadways: Backfill shall be placed up to the required elevation as specified. Water flooding or jetting methods of compaction will not be permitted.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas:

Backfill shall be deposited in layers of a maximum of 300 mm loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.9.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.10 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.10.1 Water Lines

Trenches shall be of a depth to provide a minimum cover of 1 meter from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.10.2 Heat Distribution System

Initial backfill material shall be free of stones larger than 6.3 mm in any dimension.

3.10.3 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 600 mm from the finished grade, unless otherwise indicated.

3.10.4 Pipeline/Utility Casing

Provide new smooth wall steel pipeline/utility casing under new existing pavements by the boring and/or jacking method of installation. Provide each new pipeline/utility casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated. Install pipeline/utility casing by dry boring and jacking method.

3.11 EMBANKMENTS

3.11.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. The material shall be placed in successive horizontal layers of loose

material not more than 225 mm in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.12 SUBGRADE PREPARATION

3.12.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed up to a maximum depth of 750 mm measured from the top of the subgrade and replaced with satisfactory excavated material or other approved material as directed. Low areas resulting from removal of unsatisfactory material shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 10 millimeters when tested with a 3.05 meter straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 15 mm from the established grade and cross section.

3.12.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas, each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density.

3.12.2.1 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, the top 150 mm of subgrade shall be scarified, windrowed, thoroughly blended, reshaped, and compacted.

3.12.2.2 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage laboratory maximum density for the full depth of the shoulder.

3.13 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.14 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

3.14.1 Subgrade and Embankments

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No base course, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall base, surfacing, or pavement, be placed on a muddy, spongy, or frozen subgrade.

3.14.2 Capillary Water Barrier

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.14.3 Grading Around Structures

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has

been accepted.

3.15 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50 mm depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness as shown on the plans and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil shall be obtained from offsite areas as per Specification 02921 Seeding.

3.16 TESTING

Testing shall be performed by an approved commercial testing laboratory. Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2167 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. Minimum sampling and testing shall be in accordance with Table 1, SECTION 01451, CONTRACTOR QUALITY CONTROL.

3.16.1 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 900 mm (36 inches) shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

3.17 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall

be disposed of in the designated disposal areas as shown and as specified in SECTION 02220, Demolition or SECTION 02231, Clearing and Grubbing. All other materials not indicated to be accepted in the designated disposal areas shall be disposed of outside the limits of Government-controlled land..

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SECTION 02373

GEOTEXTILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4354	(1999) Sampling of Geosynthetics for Testing
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4759	(2002) Determining the Specification Conformance of Geosynthetics

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

SD-04 Samples

SD-07 Certificates

Geotextile

A minimum of 7 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the

geotextile manufacturer.

1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

1.3.1 Delivery

The Contracting Officer shall be notified a minimum of 24 hours prior to delivery and unloading of geotextile rolls. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 71 degrees C 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

2.1.1 Geotextile

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values

(MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	N	700	ASTM D 4632
SEAM STRENGTH	N	630	ASTM D 4632
PUNCTURE	N	290	ASTM D 4833
TRAPEZOID TEAR	N	250	ASTM D 4533
APPARENT OPENING SIZE	U.S. SIEVE	100	ASTM D 4751
PERMITTIVITY	SEC -1	2.50	ASTM D 4491
ULTRAVIOLET DEGRADATION	PERCENT	70 AT 500 HRS	ASTM D 4355

2.1.2 Thread

Sewn seams shall be constructed with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY ASSURANCE SAMPLES AND TESTS

3.1.1 Quality Assurance Samples

The Contractor shall provide assistance to the Contracting Officer in the collection of quality assurance samples. Samples shall be collected upon delivery to the site for quality assurance testing at the request of the

Contracting Officer. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 1 meter long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

3.1.2 Quality Assurance Tests

The Contractor shall provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 02300, EARTHWORK.

3.2.2 Placement

The Contractor shall notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 300 mm at all longitudinal and transverse joints. Where seams must be oriented across the slope, the upper panel shall be lapped over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.3.2 Sewn Seams

Factory and field seams shall be continuously sewn on all slopes steeper than 1 vertical on 4 horizontal The stitch type used shall be a 401 locking chain stitch or as recommended by the manufacturer. For field and factory seams which are sewn, the Contractor shall provide at least a 2-meter sample of sewn seam before the geotextile is installed. For seams that are

field sewn, the seams shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. Quality Assurance seam samples shall be provided to the Government at the request of the Contracting Officer. Seam strength shall meet the minimum requirements specified in Table 1. The thread at the end of each seam run shall be tied off to prevent unraveling. Skipped stitches or discontinuities shall be sewn with an extra line of stitching with a minimum of 450 mm of overlap.

3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 7 days after installation.

3.5 REPAIRS

Torn or damaged geotextile shall be repaired. Clogged areas of geotextile shall be removed. Repairs shall be performed by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 300 mm 12 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile rolls which cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to the Government

3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed by methods recommended by the geotextile manufacturer.

3.7 COVERING

Geotextile shall not be covered prior to inspection and approval by the Contracting Officer. Cover soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. On side slopes, soil backfill shall be placed from the bottom of the slope upward. Cover soil shall not be dropped onto the geotextile from a height greater than 1 m 3 feet. No equipment shall be operated directly on top of the geotextile without approval of the Contracting Officer. Equipment with ground pressures less than 50 kPa shall be used to place the first lift over the geotextile. A minimum of 300 mm 12 inches of soil shall be maintained between full-scale construction equipment and the geotextile. Cover soil material type, compaction, and testing requirements are described in Section 02300, EARTHWORK or 02630, STORM DRAINAGE. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 2.2 m/s (meters per second).

-- End of Section --

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C300	(1997) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type
AWWA C301	(1999) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
AWWA C303	(2002) Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
AWWA C500	(2002; A C500a-95) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(1994) Dry-Barrel Fire Hydrants
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C800	(2001) Underground Service Line Valves and Fittings

AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA C901	(2002) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13mm) Through 3 In. (76 mm), for Water Service
AWWA C905	(1997) Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14 In. Through 48 In. (350 mm through 1,200 mm)
AWWA C909	(2002) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm through 300 mm), for Water Distribution
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASBESTOS CEMENT PRODUCT PRODUCERS ASSOCIATION (ACPPA)

ACPPA 1344	(1988) Recommended Work Practices for A/C Pipe

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch

ASTM INTERNATIONAL (ASTM)

ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 76M	(2003) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40

ASTM D 2467	(2002) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2002) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(2001) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3839	(2002) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM F 1483	(1998) Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2002) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(1994) Hazardous Chemicals Data
NFPA 704	(2001) Identification of the Hazards of Materials for Emergency Response

NSF INTERNATIONAL (NSF)

NSF 61	(2002e) Drinking Water System Components - Health Effects

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 21	(1982; R 2000) White or Colored Silicone Alkyd Paint (Type I, High Gloss and Type II, Medium Gloss)
SSPC Paint 25	(1997; R 2000) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

1.2 PIPING

This section covers potable and nonpotable water supply distribution service lines, and connections to building service at a point approximately 1.5 m outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines less than 80 mm (3 inches) in diameter shall be galvanized steel, polyvinyl chloride (PVC) plastic, Oriented PVC plastic polyethylene, or copper tubing, unless otherwise shown or specified. Piping for water service lines 80 mm (3 inches) and larger shall be ductile iron, polyvinyl chloride (PVC) plastic, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel, unless otherwise shown or specified.

1.2.2 Distribution Lines 80 mm (3 Inches) or Larger

Piping for water distribution lines 80 mm (3 inches) or larger shall be ductile iron, polyvinyl chloride (PVC) through 900 mm (36 inch) nominal diameter plastic, Oriented PVC plastic filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe, or reinforced concrete, unless otherwise shown or specified.

1.2.3 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 1.5 m line.

1.2.4 Potable Water Lines

Piping and components of potable water systems which come in contact with the potable water shall conform to NSF 61.

1.2.5 Plastic Piping System

Plastic piping system components (PVC, polyethylene, thermosetting resin and reinforced plastic mortar pressure) intended for transportation of potable water shall comply with NSF 14 and be legibly marked with their symbol.

1.2.6 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02300 EARTHWORK, except as modified herein.

1.3 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a manufacturer's field representative present at the jobsite during the installation and testing of PE, RTRP, and/or RPMP pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, RTRP, and/or RPMP pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other condition which could have an adverse effect on the satisfactory completion and operation of the piping system.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation

The manufacturer's recommendations for each material or procedure to be utilized.

Waste Water Disposal Plan; G

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon

completion of the project and before final acceptance.

SD-06 Test Reports

Bacteriological Disinfection

Test results from commercial laboratory verifying disinfection.

SD-07 Certificates

Manufacturer's Representative

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

1.5 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.5.1 Polyethylene (PE) Pipe Fittings and Accessories

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

1.5.2 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations.

Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Plastic Pipe

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.2 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 100 mm (4 inch) Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure MPa	Minimum Hydrostatic Pressure MPa
26	0.689	0.917
21	0.827	1.103
17	1.034	1.379
13.5	1.379	1.834

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 MPa (150 psi) working pressure and 1.38 MPa (200 psi) hydrostatic test pressure.

b. Pipe 100 through 300 mm Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions,

elastomeric-gasket joint, unless otherwise shown or specified.

c. Pipe 350 through 900 mm Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

2.1.1.3 Oriented Polyvinyl Chloride (PVCO) Plastic Pipe

Pipe, couplings, and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454-B. Pipe shall conform to AWWA C909, Class 150, and to ASTM F 1483 and shall have an outside diameter equal to cast iron outside diameter.

2.2 FITTINGS AND SPECIALS

2.2.1 PVC Pipe System

a. For pipe less than 100 mm (4 inch) diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings; fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467; and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

b. For pipe 100 mm (4 inch) diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 1.03 MPa (150 psi) pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

2.3 JOINTS

2.3.1 Gaskets for Reinforced Concrete Pipe

Rubber-gasket joints shall be of the type using a bell-and-spigot joint design of steel. The gaskets shall conform to AWWA C300, AWWA C301, or AWWA C303, as applicable.

2.3.2 Plastic Pipe Jointing

2.3.2.1 PE Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation, and as approved by the Contracting Officer.

2.3.2.2 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

2.3.2.3 PVCO Pipe

Joints shall conform to ASTM D 3139. Elastomeric gaskets shall conform to ASTM F 477.

2.3.3 Bonded Joints

For all ferrous pipe, a metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

2.3.4 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.

b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

2.4 VALVES

2.4.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 1.03 MPa (150 psi). Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Valves smaller than 80 mm (3 inches) shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

b. Valves 80 mm (3 inches) and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

2.4.2 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which shall be attached to each post.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 5 mm. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 21 MPa in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 125 mm (5 inches) in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 200 mm above the ground grade . Hydrants shall have a 150 mm (6 inch) bell connection, two 65 mm (2-1/2 inch) hose connections and one 115 mm (4-1/2 inch) pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with 1 coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and 2 finish coats of silicone alkyd paint conforming to SSPC Paint 21,of the installation's standard colors or as directed by the Contracting Officer . Suitable bronze adapter for the 115 mm (4-1/2 inch) outlet, with caps, shall be furnished.

2.8 MISCELLANEOUS ITEMS

2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap

type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.8.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

2.8.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88M , Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.8.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 1.375 MPa (200 psi).

2.8.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1.03 MPa. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 67.8 Newton meters (50 foot-pound).

2.8.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.8.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 3 m from a sewer except where the bottom of the water pipe will be at least 300 mm above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 1.8 m from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 3 m each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 900 mm horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 600 mm above the sewer main. Joints in the sewer main, closer horizontally than 900 mm to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing Lines

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 300 mm shall be maintained between pipes.

3.1.2.5 Casing Pipe

Where sleeves are required, in all other cases, the pipe sleeve shall be reinforced concrete in accordance with ASTM C 76M and, Class V as specified

for storm drains in Section 02630 STORM DRAINAGE. A minimum clearance of at least 50 mm between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve.

3.1.2.6 Structures

Where water pipe is required to be installed within 1 m of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.3 Joint Deflection

3.1.3.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

3.1.3.2 Allowable for Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Plastic Pipe Installation

RTRP shall be installed in accordance with ASTM D 3839. RPMP shall be installed in accordance with the manufacturer's recommendations. PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be

installed in accordance with AWWA M23.

3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA 1344.

3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.4.4 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.5 Jointing

3.1.5.1 PE Pipe Requirements

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

3.1.5.2 PVC Plastic Pipe Requirements

a. Pipe less than 100 mm (4 inch) diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with ASTM F 477 and as specified. Pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.

b. Pipe 100 through 300 mm diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm (4 inch) diameter with

configuration using elastomeric ring gasket.

c. Pipe 350 through 900 mm diameter: Joints shall be elastomeric gasket push-on joints made in accordance with AWWA M23.

3.1.5.3 Bonded Joints Requirements

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.4 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 3 mm thickness of coal tar over all fitting surfaces.

3.1.5.5 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 1.5 m outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 1.5 m from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Service Lines 50 mm (2 Inches) and Smaller

Service lines 50 mm (2 inches) and smaller shall be connected to the main by a directly-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in TABLE I. Where 2 or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

TABLE I. SIZE OF CORPORATION STOPS AND OUTLET

Pipe Size mm	Corporation Stops, mm For Ductile-Iron Pipe	Outlets w/Service Clamps, mm Single & Double Strap
80	--	25

TABLE I. SIZE OF CORPORATION STOPS AND OUTLET

Pipe Size mm	Corporation Stops, mm For Ductile-Iron Pipe	Outlets w/Service Clamps, mm Single & Double Strap
100	25	25
150	32	40
200	40	50
250	40	50
300 & larger	50	50

NOTE:

a. Service lines 40 mm (1-1/2 inches) and smaller shall have a service stop.

b. Service lines 50 mm (2 inches) in size shall have a gate valve.

3.1.6.2 Service Lines Larger than 50 mm (2 Inches)

Service lines larger than 50 mm (2 inches) shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 80 mm (3 inches) and larger may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.6.3 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

3.1.7 Setting of Fire Hydrants, Meters, Valves and Valve Boxes

3.1.7.1 Location of Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 150 mm (6 inch) branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 450 mm above the finished surrounding grade, and the operating nut not more than 1.2 m above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 450 mm above the finished surrounding grade, the top of the hydrant not more than 600 mm above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished grade immediately after

installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 100 mm thick and 400 mm square. Not less than 2 cubic meters of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.7.2 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 1.2 m on all sides of the box, or the undisturbed trench face if less than 1.2 m.

3.1.7.3 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.8 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.9 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 100 mm (4 inches) in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down

bends into gravity thrust blocks.

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved. The Contractor shall submit for approval a Waste Water Disposal Plan for this and other tests.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02300 EARTHWORK.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 1.38 MPa pressure. Water supply lines designated on the drawings shall be subjected to a pressure equal to 1.38 MPa. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 34.5 kPa (5 psi) of the specified leakage test pressure after the pipe has

been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to 0.5 power)

L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

a. Pressure test and leakage test may be conducted concurrently.

b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 BACTERI0LOGICAL DISINFECTION

3.3.1 Disinfection Procedure

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as specified. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide

a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times.

3.3.2 Sampling

From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water.

3.3.3 Acceptance Requirements

The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed. The Contractor shall submit a statement of Satisfactory Installation as specified in the Submittals paragraph.

-- End of Section --

SECTION 02521

WATER WELLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C654	(1997) Disinfection of Wells

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2002ae1) Portland Cement
ASTM D 2239	(2003) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 5299	(1999) Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

1.2 MEASUREMENT AND PAYMENT

Payment for each specified item will be made at the contract unit price for that item. Payment will include full compensation for equipment, materials and labor for drilling; removal and disposal of temporary casing, cuttings, and drill fluid; preparation of borehole logs; and sample handling, containers, storage, and testing. Depth, logging, installation, casing, riser pipe, and well screen shall be measured by linear distance. Payment will not be allowed for test holes or wells abandoned due to construction practices not in accordance with this specification, faulty construction practices or for the convenience of the Contractor.

1.2.1 Water Well

Compensation for the water well will be made at the contract unit price and will include material, equipment, and labor required to drill, develop, perform tests, and complete the permanent well. Depth shall be measured as

the total linear distance between ground surface and bottom of hole. If the total depth of well is greater than that specified in the contract for "Water Well," the additional depth will be paid for at the contract unit price for "Additional Water Well Depth."

1.2.2 Well or Test Hole Decommissioning/Abandonment

Permanent decommissioning/abandonment of wells or test holes will be paid for only if it becomes necessary to abandon a well or test hole as specified, and only for work completed and accepted as specified. Payment will include compensation for drilling, casing removal, well sampling, materials, cement, mixing of cement, bentonite, and water, pumping of grout, equipment, removal of foreign objects, and transportation necessary to abandon the well or test hole and for the required well or test hole abandonment records.

1.2.3 Site Cleanup

Separate payment will not be made for cleanup of the site. Cleanup will mean restoring the site to its pre-construction condition, in accordance with paragraph SITE CLEANUP. Cleanup will be considered part of and incidental to the drilling, construction, and/or decommissioning of the well.

1.3 GENERAL REQUIREMENTS

The well shall be located as shown, and be constructed in accordance with these specifications. Each well shall be installed to prevent aquifer contamination by the drilling operation and equipment, intra- and inter-aquifer contamination, and vertical seepage of surface water adjacent to the well into the subsurface, especially the well intake zone.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Diagrams; G.

As-built installation diagram for each well installed, prepared by the geologist present during well installation operations, within 30 working days of the completion of the well installation procedure.

SD-03 Product Data

Well Installation Plan; G.

A plan as specified in paragraph WELL INSTALLATION PLAN

describing the drilling methods, sampling, and well construction and well development 30 calendar days prior to beginning drilling operations. Mobilization activities may start prior to submittal of the plan. The plan shall be approved and signed by an experienced geologist as specified in paragraph QUALIFICATIONS.

Well Material

Catalog data, and name of supplier, for well screens (to include the screen slot size), casing, riser pipe, filter pack material, bentonite, cement, centralizers, surface protective covers, well vaults, locking caps, airline oil filters for pneumatic drilling, dedicated sampling equipment, pumps, and chemical specifications on drill lubricants, tracers, disinfecting agents, and drill fluid additives, if used. Catalog data shall include any information, written or otherwise, supplied by the manufacturers or suppliers of the above listed items.

Qualifications

Personnel qualification documentation.

Site Conditions

A copy of all permits, licenses, or other legal requirements necessary for execution of the work shall be furnished 10 working days before commencement of the work.

Geophysical Logging

The Contractor shall prepare a graphic boring log to scale showing the required details. Five prints of the boring log drawing shall be submitted within 30 working days after completion of the test hole. This drawing shall be used for determining the well design, design of the filter pack, well screen location and screen openings.

SD-06 Test Reports

Survey Maps and Notes

Survey maps and notes, including a tabulated list of all wells and monuments, copies of all field books, maps showing the locations, and elevations of all wells, datum used (e.g. state plane NAD27, NAD83, UTM, etc.), elevation datum, units of measurement, and all computation sheets shall be submitted within 30 working days after completion of the survey. Also, a diagram showing where on the top of the well the elevation was determined by the surveyor.

Well Development Records

A well development record, for each well, within 10 working days of the completion of development.

Geophysical Logs

Interpreted geophysical logs shall be submitted within 10 working days of the completion of said logging.

Decommissioning/Abandonment Records

A well decommissioning record, for each well, or test hole abandoned, within 30 working days of the completion of the abandonment procedure.

Project Photographs

Before, during, and after completion of the work, the Contractor shall take photographs of each well installation site. Photographs shall also be taken of any rock that is cored at the site.

Water Source

Decontamination and drilling water source analytical test results shall be submitted within 30 working days before beginning drilling operations.

Tests.

Test Reports within 24 hours following the conclusion of each test.

SD-07 Certificates

Casing

Cement and Bentonite Grout

Air line and gauge

Water removed

1.5 WELL INSTALLATION PLAN

The following requirements shall be incorporated into the Contractor's Well Installation Plan and followed in the field. The plan shall include, but shall not be limited to, a discussion of the following:

a. Description of well drilling methods, and installation procedures, including any temporary casing used, placement of filter pack and seal materials, drill cuttings and fluids disposal, and soil/rock sample disposition.

b. Description of well construction materials, including well screen, riser pipe, centralizers, air line and gauge, tailpiece (if used), filter pack and filter pack gradation, bentonite or drilling mud, drilling fluid additives (if used), drilling water, cement, and well protective measures.

c. Description of quality control procedures to be used for placement of filter pack and seals in the boring, including depth measurements.

d. Forms to be used for written boring logs, installation diagrams of wells, geophysical logs, well development records, well sampling data records, state well registration forms, and well abandonment records.

e. Description of contamination prevention and well materials and equipment decontamination procedures.

f. Description of protective cover surface completion procedures, including any special design criteria/features relating to frost heave prevention. The maximum frost penetration for the site shall be included in this description.

g. Description of well development methods to be used.

h. List of applicable publications, including state and local regulations and standards.

i. List of personnel assignments for this project, and personnel qualifications.

j. Description of well decommissioning/abandonment procedures.

k. Description of well capacity testing techniques.

l. Description and discussion of geophysical techniques to be employed at the site.

m. Description of permanent pump to be installed, and discussion of pump operating tests to be employed at the site.

n. Description of specific methods to be employed to control potential contamination or pollution arising from well installation activities.

1.6 QUALIFICATIONS

A geologist with at least 3 years experience in well installation, registered in the state of Washington, shall be on site and responsible for well pump and pitless adapter installation, developing and testing activities. Geophysical log interpretation shall be done by a qualified log analyst. The log analyst shall be able to demonstrate competence through background, training, and experience when so called upon. The Contractor shall have a minimum of 5 years of well installation experience. The Contractor's staff shall include appropriate health and safety personnel as specified in Section 01351 SAFETY, HEALTH AND EMERGENCY RESPONSE (HTRW/UST), and personnel qualified to perform the necessary chemical sampling as presented in the approved Sampling and Analysis Plan, prepared as specified in Section 01450 CHEMICAL DATA QUALITY CONTROL.

1.7 ABANDONMENT OF WELLS

If the Contractor fails to construct a well of the required capacity, or if the well is abandoned because of loss of tools, or for any other cause, the Contractor shall abandon the hole as specified in paragraph WELL DECOMMISSIONING/ABANDONMENT.

1.8 NOTIFICATION

The Contracting Officer shall be responsible for contacting the State of Washington Department of Ecology in accordance with the applicable reporting requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

Well materials shall be stored and maintained in a clean, uncontaminated condition throughout the course of the project.

PART 2 PRODUCTS

2.1 CASING

All casing, screen, and other well material shall be of compatible materials to prevent galvanic reaction between components of the completed well.

2.2 BENTONITE SEAL

The bentonite seal, intended to keep grout from entering the filter pack, shall consist of hydrated granular, or pelletized, sodium montmorillonite furnished in sacks or buckets from a commercial source and shall be free of impurities which adversely impact the water quality. If the bentonite seal is located above any borehole fluid levels, a layer of fine sand shall be placed at the top of the bentonite seal, to provide an additional barrier to any downward migration of grout.

2.3 CEMENT AND BENTONITE GROUT

2.3.1 Cement Grout

Cement grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Cement grout shall be proportioned not to exceed 2 parts, by weight, of sand to 1 part of cement with not more than 23 liters of water per 42.6 kg of Portland cement, with a mixture of such consistency that the well can be properly grouted. No more than 5 percent by weight of bentonite powder may be added to reduce shrinkage.

2.3.2 Bentonite Grout

High-solids bentonite grout shall be made from sodium bentonite powder and/or granules. Water from an approved source shall be mixed with these powders or granules to form a thick bentonite slurry. The slurry shall consist of a mixture of bentonite and the manufacturer's recommended volume of water to achieve an optimal seal. The slurry shall contain at least 20 percent solids by weight and have a density of 4.3 kg/L of water or greater.

2.4 PERMANENT PUMP

Permanent pump shall be an approved submersible type with a capacity sufficient to deliver 4.0L/s . The pump shall be connected to the pump controls by a three-wire drop line. Piping for the well drop line shall be polyethylene plastic pipe conforming to ASTM D 2239. The pump shall operate on 208 volts, 60 Hz, 3-phase power, and the motor shall be of sufficient size to operate the pump under the maximum operating conditions without exceeding its rating. Pump shall be equipped with motor cooling shroud andnecessary controls to provide for automatic operation of the pump. The pump and motor unit shall be no larger than 100 mm in diameter at any point.

PART 3 EXECUTION

3.1 PROTECTION OF EXISTING CONDITIONS

The Contractor shall maintain existing survey monuments and wells, and protect them from damage from equipment and vehicular traffic. Any items damaged by the Contractor shall be repaired by the Contractor. Wells requiring replacement due to Contractor negligence shall be re-installed according to these specifications. Wells scheduled for abandonment shall be protected from damage so that abandonment may be performed according to these specifications. Prior to excavation, the Contractor shall obtain written approval from the local utility companies to drill at each site, to avoid disturbing buried utilities.

3.2 INSTALLATION OF PERMANENT PUMP

The permanent well pump shall be installed in the well with motor end at a approximate depth of 23 m below the maximum drawdown groundwater level after the drawdown test has been completed. Actual installed pump location will be provided to the contractor by the government. The pump shall be secured at the required elevation as recommended by the pump manufacturer. After installation of the pumping units and appurtenances is complete,

operating tests shall be carried out to assure that the pumping installation operates properly. Tests shall assure that the pumping units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

3.3 DISINFECTING

After completion of tests of well, or installation of permanent pump, or at time of tests for yield and drawdown test, whichever is later, the wells shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity so that a concentration of at least 50 ppm of chlorine shall be obtained in all parts of the well. Chlorine solution shall be prepared and introduced into the well in an approved manner and shall remain in the well for period of at least 12 hours but not more than 24 hours. Information on methods for preparing chlorine solution and introducing it into the well may be found in AWWA C654. After the contact period, the well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The well shall be pumped to waste for an additional 15 minutes with less than 1 ppm chlorine residual after which two samples shall be taken not less than 30 minutes apart and tested for the presence of coliform bacteria. The well shall be disinfected and redisinfected as may be required until two consecutive samples of water are found upon test to be free from Coli Acrogenes group of organisms.

3.4 PITLESS ADAPTER, STILLING TUBE AND SLAB

Pitless adapter shall be constructed preventing the infiltration of surface water or precipitation into the well. Adapter shall provide a watertight subsurface connection for the buried pipe discharge. Buried pipe shall exit the adapter below the frost line, or at a depth greater than 450 mm below grade. Contractor shall provide sealed attachment, allowing pump removal without damage to underground discharge pipe. Removal of adapter and pump shall provide complete, unblocked access to the well casing for repair or cleaning. Contractor shall provide a tamperproof low profile well cap over pitless adapter. Contract shall provide stilling tube for measuring well water level. The slab shall be 1.2m square by 150 mm thick and constructed of reinforced concrete.

3.5 SITE CLEAN-UP

After completion of the work, tools, appliances, surplus materials, temporary drainage, rubbish, and debris incidental to work shall be removed. Excavation and vehicular ruts shall be backfilled and dressed to conform with the existing landscape. Utilities, structures, roads, fences, or any other pre-existing item which must be repaired or replaced due to the Contractor's negligence shall be the Contractor's responsibility; repair or replacement shall be accomplished prior to completion of this contract.

3.6 SURVEYS

Coordinates and elevations shall be established for each well/test hole.

Horizontal coordinates shall be determined to the closest 300 mm and referenced to the State Plane Coordinate System, or Universal Transverse Mercator (UTM). If the State Plane Coordinate System/UTM is not readily available, an existing local grid system shall be used. A ground elevation to the closest 30 m shall be obtained at each well. The highest point on the top of the riser pipe will serve as a measurement point. The elevation of the well shall reference this point, and shall be surveyed to the nearest 3 mm using the North American Vertical Datum of 1988. If the datum is not readily available, the existing local vertical datum shall be used. The location, identification, coordinates, and elevations of the well and monuments shall be plotted on maps with a scale large enough to show their location with reference to other structures.

3.7 WELL DECOMMISSIONING/ABANDONMENT

Any well disapproved by the Contracting Officer, or any well decommissioned/abandoned by the Contractor for any reason shall be decommissioned/abandoned according to the requirements of the State of Washington, ASTM D 5299, and the requirements of these specifications. Well decommissioning/abandonment includes the removal of all materials left in the borehole/well, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole before the decision was made to abandon the borehole/well. Test holes decommissioned/abandoned for any reason shall be grouted from the bottom to within 300 mm of the top of the ground surface according to the protocol for grout/bentonite placement established in paragraph Grout Placement, using the grout mix specified in paragraph CEMENT AND BENTONITE GROUT. The top 300mm shall be backfilled with material appropriate for the intended land use. The Contractor shall maintain a well decommissioning/abandonment record as specified in paragraph Well Decommissioning/Abandonment Records. Groundwater levels, if encountered before the decision is made for decommissioning/abandonment, shall be measured in all borings prior to backfilling. These water levels shall be included in the well decommissioning/abandonment records. No well shall be decommissioned/abandoned without the approval of the Contracting Officer.

3.8 DOCUMENTATION AND QUALITY CONTROL REPORTS

The Contractor shall establish and maintain documentation and quality control reports for well construction and development to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

-- End of Section --

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SECTION 02531

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 74	(2003b) Cast Iron Soil Pipe and Fittings
ASTM C 150	(2002ae1) Portland Cement
ASTM C 270	(2003) Mortar for Unit Masonry
ASTM C 443M	(2002) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C 478M	(2003) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 923M	(2002) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric)
ASTM C 94/C 94M	(2003a) Ready-Mixed Concrete
ASTM C 969M	(2002) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM C 990M	(2003) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other

	Gravity-Flow Applications
ASTM D 2412	(2002) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	(2003) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for the Low-Pressure Air Testing of Installed

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals mm lines of acrylonitrile-butadiene-styrene (ABS) composite plastic pipeorpolyvinyl chloride (PVC) plastic pipeat the Contractor's option. Provide building connections mm lines of cast iron soil pipe acrylonitrile-butadiene-styrene (ABS) solid-wall plastic pipe or polyvinyl chloride (PVC) plastic pipe at the Contractor's option.

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 1.5 m outside of building walls.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02300 EARTHWORK. Backfilling shall be accomplished after inspection by the Contracting Officer. . Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast concrete manhole

Metal items

Frames, covers, and gratings

SD-03 Product Data

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-07 Certificates

Portland Cement

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300 CAST-IN-PLACE CONCRETE."

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements

specified below.

2.1.1 Cast-Iron Soil Piping

2.1.1.1 Cast-Iron Hub and Spigot Soil Pipe and Fittings

ASTM A 74, service, with ASTM C 564 compression-type rubber gaskets.

2.1.1.2 Cast-Iron Hubless Soil Pipe and Fittings

CISPI 301 with CISPI 310 coupling joints.

2.1.2 Clay Piping

2.1.2.1 Clay Pipe and Fittings

ASTM C 700, standard strength .

2.1.2.2 Clay Piping Jointing Materials

ASTM C 425.

2.1.3 ABS Composite Plastic Piping

2.1.3.1 ABS Composite Plastic Pipe and Fittings

ASTM D 2680.

2.1.3.2 Jointing Materials for ABS Composite Plastic Piping

Solvent cement and primer shall conform to ASTM D 2680.

2.1.4 ABS Solid-Wall Plastic Piping

2.1.4.1 ABS Solid-Wall Plastic Pipe and Fittings

ASTM D 2751, SDR 35, with ends suitable for either solvent cement joints or elastomer joints.

2.1.4.2 ABS Solid-Wall Plastic Joints and Jointing Materials

Solvent cement for solvent cement joints shall conform to ASTM D 2235. Elastomeric joints shall conform to ASTM D 3212. Gaskets for elastomeric joints shall conform to ASTM F 477.

2.1.5 PVC Plastic Gravity Sewer Piping

2.1.5.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.5.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 28 MPa at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 17 MPa minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days. Text

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes and Glass-Fiber-Reinforced Polyester Manholes.

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478M; base and first riser shall be monolithic. Glass-Fiber-Reinforced Polyester Manholes shall conform to ASTM D 3753.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443M. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923M or ASTM C 990M.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting

rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, kPa	ASTM D 412	12,684	15,132	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, N/mm	ASTM D 624 (Die B)	49	28	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as follows:

a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A
Cover: Figure 8, Size 22A
Steps: Figure 19

b. Non-traffic manhole:

Frame: Figure 4, Size 22
Cover: Figure 12, Size 22
Steps: Figure 19

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 181.4 kg (400 pounds). Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Ladderss

A steel ladder shall be provided where the depth of a manhole exceeds 3.6 m (12 feet). The ladder shall not be less than 406 mm (16 inches) in width, with 19 mm (3/4 inch) diameter rungs spaced 305 mm (12 inches) apart. The two stringers shall be a minimum 10 mm (3/8 inch) thick and 51 mm (2 inch) wide. Ladders and inserts shall be galvanized after

fabrication in conformance with ASTM A 123/A 123M.

2.3.4.3 Septic Tank Piping

Cast iron soil pipe and fittings.

2.3.4.4 Siphon for Septic Tank

Welded steel or close-grained cast iron free from flaws, of an approved standard design, and prompt and positive in action.

2.3.5 Sewage Absorption Field Materials

Pipe shall be perforated bell-and-spigot clay pipe conforming to ASTM C 700, clay drain tile, perforated corrugated polyethylene tubing conforming to ASTM F 405. Covering for open joints in drain tile lines shall be asphalt-treated paper or asphalt-covered fibrous glass cloth. Wire for fastening covering to tile shall be 1.2 mm, nonferrous metal composition.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 1.5 m from the building . Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 3 m to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 3 m on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance.Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 0.9 m, horizontal distance, to the water line.

a. Sanitary piping installation parallel with water line:

(1) Normal conditions: Sanitary piping or manholes shall be laid at least 3 m horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual conditions: When local conditions prevent a horizontal separation of 3 m, the sanitary piping or manhole may be laid closer to a water line provided that:

(a) The top (crown) of the sanitary piping shall be at least 450 mm below the bottom (invert) of the water main.

(b) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of sanitary piping crossing a water line:

(1) Normal conditions: Lay sanitary piping crossing water lines to provide a separation of at least 450 mm between the top of the sanitary piping and the bottom of the water line whenever possible.

(2) Unusual conditions: When local conditions prevent a vertical separation described above, use the following construction:

(a) Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

(b) Sanitary piping passing over water lines shall, in addition, be protected by providing:

1. A vertical separation of at least 450 mm between the bottom of the sanitary piping and the top of the water line.

2. Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

3. That the length, minimum 6.1 m, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02300 EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell or groove ends in the upgrade direction. Adjust spigots in bells and tongues in grooves to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or

bulkheads. Provide batterboards not more than 7.50 m apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of Cast Iron Soil Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the pipe manufacturer. Make joints with the rubber gaskets specified for cast iron soil pipe joints and assemble in accordance with the recommendations of the pipe manufacturer.

3.1.2.2 Installation of Clay Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM C 12 for pipe laying. Make joints with a compression joint material specified for clay pipe joints and assemble in accordance with the recommendations of the manufacturer of the pipe.

3.1.2.3 Installation of ABS Composite Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.4 Installation of ABS Solid-Wall Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make solvent cement joints with the solvent cement previously specified for this type joint. Make elastomeric joints with the gaskets specified for this type joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.5 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.4 Miscellaneous Construction and Installation

3.1.4.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.4.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.5 Sewage Absorption Trench Construction

Grade pipe lines uniformly downward to the outlet. Lay perforated pipe with the perforations downward. Lay drain tile with 6 mm open joints. Cover open joints of drain tile with the cover material specified so that it extends not less than 1.75 rad on each side of the vertical center line of the tile. Wire covering in place.

3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and

cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01005 SITE SECIFIC SUPPLEMENTARY REQUIREMENTS. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969M. Make calculations in accordance with the Appendix to ASTM C 969M.

b. Low-pressure air tests: Perform tests as follows:

(1) Clay pipelines: Test in accordance with ASTM C 828. Allowable pressure drop shall be as given in ASTM C 828. Make calculations in accordance with the Appendix to ASTM C 828.

(4) ABS composite plastic pipelines: Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

(5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D 2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

   (1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

   (2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4 degrees C, and shall have a surface Brinell hardness of not less than 150.

   (3) Center bored and through-bolted with a 6 mm minimum diameter steel shaft having a yield strength of not less than 483 MPa, with eyes or loops at each end for attaching pulling cables.

   (4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are

obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

-- End of Section --

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SECTION 02620

SUBSURFACE DRAINAGE (LEACHING) CHAMBER

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Data

Leaching Chamber;

Data shall consist of manufacturer's descriptive and technical literature for leaching chamber

SD-08 Instructions

Installation Procedures;

Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Contracting Officer prior to installation.

1.2 DELIVERY, STORAGE AND HANDLING

1.2.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unleaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and exposure to the direct sunlight over extended periods.

1.2.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition.

1.3 DESIGN REQUIREMENTS

Installed leaching system with 450 mm backfill cover shall meet H-20 load rating under AASHTO-01

PART 2 PRODUCTS

2.1 Subsurface Drainage (Leaching) Chamber

The subsurface drainage (leaching) chamber, is system to receive effluent and allow it to drain or infiltrate into the surrounding soil.

2.1.1 Provide standard manufactured units for this purpose formed of high density molded polyethylene conforming to the following::

a. Units shall be arch shaped, with open-bottom.

b. Nominal size of individual units shall be 850 mm width (min) by 350 mm (min.) depth in standard manufacturers lengths that shall be interlocked to provide the overall length shown on plans.

c. Each unit shall have a minimum of .03 square meter of sidewall opening per linear 300 mm. Openings shall be 0.5 mm wide.

d. Each unit shall have a minimum bearing footprint of 0.14 to 0.19 square meters.

e. Units shall include standard end plates with distribution pipe inlets. Distribution pipe inlets shall be a minimum of 100 mm diameter pipe or as indicated on the plans.

f. Each unit shall be designed with interlocking joints for field installation.

g. Polyethylene used in molded units shall have a minimum density of 0.095 gm/cm^3

2.2 Drain Gravel

Drain gravel shall be of the type and thickness shown. Drain gravel shall be clean, gravel free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 422.

U.S. Standard Sieve Size	Percent Passing by Weight
37.5 mm (1-1/2)	100
19 mm (3/4 inch)	0-20
10 mm (3/8 inch)	0-2

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Drainage (Leaching) Chambers

Excavation of trenches and backfilling for the subsurface drainage (leaching) chambers shall be in accordance with the applicable portion of

Section 02300 EARTHWORK and the installation of the subsurface (leaching)chambers shall be in accordance with the manufacturer's recommendations except provide 300 mm of drain gravel below and at the sidewalls of the chambers.

-- End of Section --

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SECTION 02630

STORM DRAINAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(2003) Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 48/A 48M	(2000) Gray Iron Castings
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 929/A 929M	(2001) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM C 231	(2003) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(2003) Mortar for Unit Masonry
ASTM C 425	(2002) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443M	(2002) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C 478M	(2003) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 655	(2002) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

ASTM C 828	(2003) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 877M	(2002) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections (Metric)
ASTM C 923M	(2002) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric)
ASTM C 924M	(2002) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric)
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1999) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2729	(2003) Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(2002a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 1417	(1992; R 1998) Installation Acceptance of Plastic Gravity Sewer Lines Using Low

	Pressure Air
ASTM F 679	(2003) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(2003) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(2003) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-07 Certificates

Resin Certification
Pipeline Testing
Hydrostatic Test on Watertight Joints
Determination of Density
Frame and Cover for Gratings

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt

and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76M ClassII, or ASTM C 655, 50 newtons per linear meter per mm of diameter D-Load.

2.1.2 PVC Pipe

ASTM D 2729.

2.1.3 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.

2.1.3.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the

requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.4 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

2.1.4.1 Smooth Wall PE Pipe

ASTM F 714, maximum DR of 21 for pipes 80 to 600 mm in diameter and maximum DR of 26 for pipes 650 to 1200 mm in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 335434C.

2.1.4.2 Profile Wall PE Pipe

ASTM F 894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 334433C. Pipe walls shall have the following properties:

		Minimum Moment Of Inertia of Wall Section (mm to the 4th/mm)	
Nominal Size (mm)	Minimum Wall Area (square mm/m)	Cell Class 334433C	Cell Class 335434C
450	6300	850	620
525	8800	1150	840
600	9900	1330	970
675	12500	2050	1490
750	12500	2050	1490
825	14800	2640	2160
900	17100	3310	2700
1050	16500	4540	3720
1200	18700	5540	4540

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for _20____ MPa concrete under Section 03300 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 37.5 mm. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 25 mm thick for covers and not less than 40 mm thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 75 mm between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 25_____ liters of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478M . Joints between precast concrete risers and tops shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

2.3.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48/A 48M, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.5 Joints

2.3.5.1 Flexible Watertight Joints

a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443M . Factory-fabricated resilient joint materials shall conform to ASTM C 425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal

diameter of the pipe being gasketed exceeds 1.35 m .

b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443M. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

2.3.5.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877M .

2.3.5.3 Flexible Watertight, Gasketed Joints

a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 178 mm wide and approximately 10 mm thick, meeting the requirements of ASTM D 1056, Type 2 B3 , and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 21 mm in diameter for pipe diameters of 914 mm or smaller and 22 mm in diameter for larger pipe having 13 mm deep end corrugation. Rubber O-ring gaskets shall be 35 mm in diameter for pipe having 25 mm deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443 . Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.3.5.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3.5.5 Smooth Wall PE Plastic Pipe

Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.

2.3.5.6 Profile Wall PE Plastic Pipe

Joints shall be gasketed or thermal weld type with integral bell in

accordance with ASTM F 894.

2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the manhole exceeds 3.66 m . These ladders shall be not less than 406 mm in width, with 19 mm diameter rungs spaced 305 mm apart. The two stringers shall be a minimum 10 mm thick and 63 mm wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48/A 48M, Class 30B or 35B. Shape and size shall be as indicated.

2.6 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923M .

2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.7.1 Concrete, PVC and PE Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443M . Test requirements for joints in clay pipe shall conform to ASTM C 425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D 3212.

2.8 EROSION CONTROL RIPRAP

Provide nonerodible rock not exceeding 200 mm in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of 200 mm . The inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines will not be permitted..

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02300 EARTHWORK and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not

greater than the outside diameter of the pipe plus 600 mmmm to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200 mm or 13 mm for each meter of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02300 EARTHWORK.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.2.2 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

3.3.1 Concrete, AND PVC PIPE

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1.83 m vertically, and shall be installed to provide at least 152 mm of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7 BACKFILLING

For backfill and compaction requirements see Section 02300 EARTHWORK.3.8 PIPELINE TESTING

3.7.1 Minimum Density

3.8 PIPELINE TESTING

3.8.1 Leakage Tests

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall conform to ASTM C 828. Low pressure air testing for concrete pipes shall conform to ASTM C 924M . Low pressure air testing for plastic pipe shall conform to ASTM F 1417. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 or ASTM C 924M , after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C 1103M . Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm is provided above both the water table and the top

of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed diameter per mile) of pipeline 9 mL per mm in diameter per 100 meters (0.2 gallons per inch in diameter per 100 feet) of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.

3.8.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device. Ball, cylinder, or circular sections shall conform to the following:

   (1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

   (2) A homogeneous material throughout, with a density greater than 1.0 as related to water at 4 degrees C , and a surface Brinell hardness of not less than 150.

   (3) Center bored and through bolted with a 6 mm minimum diameter steel shaft having a yield strength of not less than 483 MPa , with eyes or loops at each end for attaching pulling cables.

   (4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved by the Contracting Officer prior to use.

c. Pull-through device: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through

with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflection, replace with new pipe, and completely retest in same manner and under same conditions.

e. Warranty period test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of one-year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

-- End of Section --

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SECTION 02722

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2003) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(2001) Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2001e1) Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 29/C 29M	(1997; R 2003) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 75	(2003) Sampling Aggregates
ASTM E 11	(2001) Wire Cloth and Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-06 Test Reports

Sampling and testing; G, RE
Field Density Tests

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor.

Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11. .

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557.

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556 or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on ABC course material in conformance with ASTM C 131.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

a. Sieve Analysis .

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square meters, or portion thereof, of completed area.

b. Sieve Analysis shall be performed for every , or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.4.4 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm sieve shall be known as coarse aggregate; that portion passing the 4.75 mm sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 1045 kg/cubic meter as determined by ASTM C 29/C 29M, and shall meet all the requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or

more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 25 mm and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02300 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC. Stabilization shall be accomplished by mixing ABC into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC is placed.

3.4 INSTALLATION

3.4.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in

a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC meeting all requirements of this specification.

3.4.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm or less than 75mm when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC.

3.4.3 Grade Control

The finished and completed ABC shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC thickness so that the finished ABC with the subsequent surface course will meet the designated grades.

3.4.4 Edges of Base Course

The ABC shall be placed so that the completed section will be a minimum of 1.5 m wider, on all sides, than the next layer that will be placed above it. Additionally, approved fill material shall be placed along the outer edges of ABC in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 600 mm width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of ABC. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.4.5 Compaction

Each layer of the ABC shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly

different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.4.6 Thickness

Compacted thickness of the aggregate course shall be as indicated No individual layer shall exceed 150 mm nor be less than 75 mm in compacted thickness. The total compacted thickness of the ABC course shall be within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm of the thickness indicated. The total thickness of the ABC course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters of base course. Measurements shall be made in 75 mm diameter test holes penetrating the base course.

3.4.7 Finishing

The surface of the top layer of ABC shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC is 13 mm or more below grade, then the top layer should be scarified to a depth of at least 75 mm and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.4.8 Smoothness

The surface of the top layer shall show no deviations in excess of 10 mm when tested with a 3.66 meter straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 15 meter intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing

material and compacting it to meet these specifications.

3.5 TRAFFIC

Completed portions of the ABC course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.6 MAINTENANCE

The ABC shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.7 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of off site, or as directed. No additional payments will be made for materials that must be replaced.

-- End of Section --

SECTION 02726

PORTLAND CEMENT PERVIOUS PAVEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(2003) Concrete Aggregates
ASTM C 42	(1999) Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 150	(2002ae1) Portland Cement
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 494	(1999) Chemical Admixtures for Concrete
ASTM D 448	(2003) Standard Sizes of Coarse Aggregate for Highway Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.

b. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment at least 7 days prior to start of paving unless otherwise specified.

c. At the time the materials are furnished for the mixture proportioning study, a description of the equipment proposed for the placing of the concrete mixture, method of control, and manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement, free of tears and other surface imperfections, including excessive paste on the surface. The literature shall show that the equipment meets all details of these specifications.

Proposed Techniques; G

a. A description of the placing and protection methods proposed prior to construction of the test section, if concrete is to be placed in or exposed to hot or cold weather conditions.

b. A detailed plan of the proposed paving pattern showing all planned construction joints. No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Contracting Officer.

c. Data on the curing media and methods to be used.

Samples for Mixture Proportioning Studies; G

The results of the Contractor's mixture proportioning studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 30 days prior to commencing concrete placing operations. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, inspected by the Government, and approved in writing, showing that mixture proportioning studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

SD-06 Test Reports

Sampling and Testing; G

Certified copies of laboratory test reports, including all test data, for cement, pozzolan, aggregate, admixtures, and curing compound proposed for use on this project. These tests shall be made by an approved independent commercial testing laboratory or by a laboratory maintained by the manufacturers of the materials. No material shall be used until notice of acceptance has been given. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

SD-0X Contractor Qualifications

Qualifications; G

The use of an ACI Concrete Flatwork Certified Finisher is required. Prior to award of the contract, the placing contractor shall furnish the Contracting Officer a statement attesting to the following qualifications and experience:

A minimum of 2 successfully completed projects with addresses, including each project's unit weight acceptance data, in-situ pavement test results including void content and unit weight, and sample of product (i.e. core of test panel).

If the placing Contractor and concrete producer have insufficient experience with portland cement pervious concrete pavement, the placing Contractor shall retain an experienced consultant (as qualified above) to monitor production, handling, and placement operations at the Contractor's expense.

1.3 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.3.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.3.2 Tests

The following tests shall be performed, in conformance with the applicable standards listed, as indicated in paragraph: PORTLAND CEMENT PERVIOUS PAVEMENT CONCRETE TESTING INSPECTION AND ACCEPTANCE.

1.3.3 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC.

1.4 WEATHER LIMITATIONS

Portland cement pervious pavement construction shall be done when the atmospheric temperature is between , unless specifically approved by the Contracting Officer. When the temperature falls below , the Contractor

shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.5 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.6 TEST PANEL

The Contractor shall place, joint and cure two test panels, each to be a minimum of at the required project thickness to demonstrate, to the satisfaction of the Contracting Officer, that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.

1.6.1 Test Panel Location

Test panels may be placed at any of the specified portland cement pervious pavement locations.

1.6.2 Test Panel Testing Requirements and Tolerances

Test panels shall be tested for the following:

Thickness: Thickness shall be accordance with ASTM C 42; Compacted thickness no less than of specified thickness.

Void Structure: Void Structure shall be tested in accordance with ASTM C 138; 12% minimum to 21% maximum.

Core Unit Weight: The core unit weight shall be in accordance with ASTM C 140, paragraph 6.3, and shall be within plus or minus of the design unit weight.

1.6.3 Test Panel Acceptance

If measured void structure falls below 15%, if measured thickness is greater than 6.3 millimeters 1/4" less than the specified thickness or measured weight falls less than below unit weight, the test panel shall be rejected and removed and disposed of at the Contractor's expense. If the test panel meets the above-mentioned requirements, it can be left in-place and included in the completed work.

PART 2 PRODUCTS

2.1 CONCRETE MIX DESIGN

Contractor shall furnish a proposed mix design with proportions of

materials to the Contracting Officer 30 days prior to commencement of work. The data shall include rodded unit weights determined in accordance with ASTM C 29 Paragraph 11, Rodded Unit Weight.

2.1.1 Proportions

2.1.1.1 Aggregate and Cement Content

The volume of aggregate, cement, water, and admixture per cu. yd. shall be equal to . when calculated as a function of the unit weight determined in accordance with ASTM C 29 rodding procedure. Fine aggregate, if used, should not exceed 3 cu. ft. . and shall be included in the total aggregate volume.

2.1.1.2 Admixtures

Shall be used in accordance with the manufacturer's instructions and recommendations.

2.1.1.3 Mix Water

Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. (Mix water yielding a cement paste with a dull-dry appearance has insufficient water for hydration).

2.1.1.4 Water Cement Ratio

Water cement ratio shall range from 0.27 to 0.35.

a. Insufficient water results in inconsistency in the mix and poor bond strength.

b. High water content results in the paste sealing the void system primarily at the bottom and poor surface bond.

2.2 MATERIALS

Locally available material having a record of satisfactory performance shall be used.

2.3 PORTLAND CEMENT PERVIOUS CONCRETE

2.3.1 Cement

Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type IP or IS conforming to ASTM C 595.

2.3.2 Aggregate

Aggregate for Portland cement pervious concrete shall be crushed gravel, stone or hydraulic cement concrete or combination there of meeting No 8 coarse aggregate (3/8 to No. 16) per ASTM C 33 or No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448. If other gradation of aggregate is to be

used, submit data on proposed material to owner for approval.

2.3.3 Admixtures

The following admixtures shall be used:

2.3.3.1 Water Reducing/Retarding Admixture

Water reducing/retarding shall be in conformance with ASTM C 494, Type D.

2.3.3.2 Hydration Stabilizer

A hydration stabilizer that also meets the requirements of ASTM C 494, Type B Retarding or Type D Water Reducing/Retarding admixtures. This stabilizer suspends cement hydration by forming a protective barrier around the cementitious particles, which delays the particles from achieving initial set.

2.3.4 Water

Potable water shall be used.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

a. Subgrade preparation shall be as specified in SECTION: 02300, EARTHWORK. Removal of unsatisfactory materials shall be as specified in SECTION: 02300, EARTHWORK. Backfill shall be satisfactory materials as specified in SECTION: 02300, EARTHWORK.

b. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.

c. Bring subgrade to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone.

3.2 RECHARGE BED INSTALLATION (NOT APPLICABLE)

3.3 PORTLAND CEMENT PERVIOUS PAVEMENT CONCRETE MIXING, HAULING AND PLACING

3.3.1 Mix Time

Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.

3.3.2 Transportation

The portland cement pervious pavement aggregate mixture may be transported

or mixed on site and should be used within one (1) hour of the introduction of mix water, unless otherwise approved by an engineer. This time can be increased to 90 minutes when utilizing the hydration stabilizer specified as long as the temperature of the concrete does not exceed 90 degrees Fahrenheit. Under no circumstance will retempering of concrete be allowed after any water adjustments have been made to delivered concrete at jobsite.

3.3.3 Base Course

Prior to placing concrete, the base course material shall be moistened and in a wet condition.

3.3.4 Discharge

Each mixer truck will be inspected for appearance of concrete uniformity. Water may be added to obtain the required mix consistency. Any water adjustments made at the jobsite shall be made by the Contractor's Quality Control representatives, only upon approval by the on-site Contracting Officer's Representative. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete. The practice of discharging onto subgrade and pulling or shoveling to final placement is not allowed.

3.3.5 Placing and Finishing Equipment

The Contractor shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force, unless otherwise approved by the Contracting Officer in writing. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than from profile grade. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immediately following the strike-off operation. After mechanical or other approved strike-off and compaction operation, no other finishing operation will be allowed. If vibration, internal or surface applied, is used, it shall be shut off immediately when forward progress is halted for any reason. The Contractor will be restricted to pavement placement widths of a maximum of fifteen (15-ft) feet unless the Contractor can demonstrate competence to provide pavement placement widths greater than the maximum specified to the satisfaction of the Engineer.

3.3.6 Curing

Curing procedures shall begin within 20 minutes after the final placement operations. The pavement surface shall be covered with a minimum thick polyethylene sheet or other approved covering material. Prior to covering, a fog or light mist shall be sprayed above the surface when required due to ambient conditions (high temperature, high wind, and low humidity). The cover shall overlap all exposed edges and shall be secured (without using

dirt or stone) to prevent dislocation due to winds or adjacent traffic conditions.

3.3.6.1 Cure Time

Portland Cement Type I, II: 7 days minimum. No truck traffic shall be allowed for 10 days (no passenger car/light trucks for 7 days).

3.3.7 Jointing

Control (contraction) joints shall be installed as indicated. They shall be installed at a depth of 1/4 the thickness of the pavement. These joints can be installed in the plastic concrete or saw cut. If saw cut, the procedure should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking (normally after curing). Transverse constructions joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden. In order to assure aggregate bond at construction joints, a bonding agent suitable for bonding fresh concrete shall be brushed, rolled, or sprayed on the existing pavement surface edge. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures.

3.4 PORTLAND CEMENT PERVIOUS PAVEMENT CONCRETE TESTING, INSPECTION, AND ACCEPTANCE

3.4.1 Laboratory Testing

Testing will be conducted by an approved independent commercial testing laboratory.

3.4.2 Testing and Acceptance

3.4.2.1 Unit Weight

A minimum of one test for each day's placement of pervious concrete in accordance with ASTM C 172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 paragraph 11, rodding procedure. The unit weight of the delivered concrete shall be +/- 5 pcf of the design unit weight.

3.4.2.2 Cores

The paving contractor shall provide two cores taken from each panel in accordance with ASTM C 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than 1/2-inch less than the specified thickness. After thickness determination, the cores shall be trimmed and measured for unit weight per ASTM C 642. Ranges of satisfactory unit weight values are +/- 5

pcf of the design unit weight. Core holes shall be filled with concrete meeting the pervious mix design per ASTM C 642.

-- End of Section --

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SECTION 02741

HOT-MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO MP 2	(2003) Superpave Volumetric Mix Design
AASHTO TP53	(2000) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

ASPHALT INSTITUTE (AI)

AI MS-02	(6th Edition; R 1997) Mix Design Methods for Asphalt
AI MS-22	(2nd Edition; R 2001) Construction of Hot-Mix Asphalt Pavements

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2003) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 1252	(2003) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 29/C 29M	(1997; R 2003) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 566	(1997) Total Evaporable Moisture Content

	of Aggregate by Drying
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 140	(2001) Sampling Bituminous Materials
ASTM D 1461	(1985; R 2001) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(2003) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(2001e1) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(2002) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 242	(1995; R 2000e1) Mineral Filler for Bituminous Paving Mixtures
ASTM D 2489	(2002) Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(2000) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D 2950	(1991; R 1997) Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D 3381	(1992; R 1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3665	(2002) Random Sampling of Construction Materials
ASTM D 3666	(2003) Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D 4125	(1994;R 2000) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D 995	(1995b; R 2002) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(2002) Test Method for Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171	(1995) Standard Test Method for Determining Percentage of Crushed Particles in Aggregate

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G, RE.

Proposed JMF.

Contractor Quality Control; G; RE.

Quality control plan.

Material Acceptance and Percent Payment; G, RE.

Acceptance test results and pay calculations.

SD-04 Samples

Asphalt Cement Binder.

(20 L)(sample for mix design verification.

Aggregates.

Sufficient materials to produce 90 kg of blended mixture for mix design verification.

SD-06 Test Reports

Aggregates; G, RE.
QC Monitoring; G, RE.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G, RE.

Copies of certified test data.

Testing Laboratory; G, RE.

Certification of compliance.

Plant Scale Calibration Certification

1.4 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved certified scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

(2) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

1.5 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.6 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.6.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.6.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 9.14 m in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

1.7 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

1.8 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, mm	Degrees C
75 or greater	4
Less than 75	7

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the 4.75 mm sieve is coarse aggregate. The portion of material passing the 4.75 mm sieve and retained on the 0.075 mm sieve is fine aggregate. The portion passing the 0.075 mm sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate or 12 percent when using sodium sulfate.

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

e. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 1200 kg/cubic meter when tested in accordance with ASTM C 29/C 29M.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419.

The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 2. Aggregate Gradations

Sieve Size, mm	Gradation 1 Percent Passing by Mass	Gradation 2 Percent Passing by Mass	Gradation 3 Percent Passing
25.0	100	---	---
19.0	76-96	100	---
12.5	68-88	76-96	100
9.5	60-82	69-89	76-96
4.75	45-67	53-73	58-78

Table 2. Aggregate Gradations

Sieve Size, mm	Gradation 1 Percent Passing by Mass	Gradation 2 Percent Passing by Mass	Gradation 3 Percent Passing
2.36	32-54	38-60	40-60
1.18	22-44	26-48	28-48
0.60	15-35	18-38	18-38
0.30	9-25	11-27	11-27
0.15	6-18	6-18	6-18
0.075	3-6	3-6	3-6

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to ASTM D 3381 Table 2, Viscosity Grade AR-4000W. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be furnished to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in AI MS-02 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. Sufficient materials to produce 90 kg of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

At the option of the contractor a currently used DOT superpave hot mix may be used in lieu of developing a new hot mix design study as described herein. The superpave volumetric mix shall be designed in accordance with AASHTO MP 2.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade.

e. Number of blows of hammer per side of molded specimen.

f. Laboratory mixing temperature.

g. Lab compaction temperature.

h. Temperature-viscosity relationship of the asphalt cement.

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-02.

k. Specific gravity and absorption of each aggregate.

l. Percent natural sand.

m. Percent particles with 2 or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles (in coarse aggregate).

p. Tensile Strength Ratio(TSR).

q. Antistrip agent (if required) and amount.

r. List of all modifiers and amount.

s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph RECYCLED HOT-MIX ASPHALT, if RAP is used.

Table 3. Marshall Design Criteria

Test Property	75 Blow Mix	50 Blow Mix
Stability, newtons minimum	*8000	*4450
Flow, 0.25 mm	8-16	8-18
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (VMA), (minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.0
Gradation 3	15.0	15.0
TSR, minimum percent	75	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.
** Calculate VMA in accordance with AI MS-02, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory jmf design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 4. Field (Plant) Established JMF Tolerances

Sieves	Adjustments (plus or minus), percent
12.5 mm	3
4.75 mm	3
2.36 mm	3
0.075 mm	1
Binder Content	0.4

If adjustments are needed that exceed these limits, a new mix design shall

be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; while not desirable, this is acceptable.

2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 50 mm. The recycled HMA mix shall be designed using procedures contained in AI MS-02 and AI MS-22. The job mix shall meet the requirements of paragraph MIX DESIGN. The amount of RAP shall not exceed 30 percent.

2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure.

2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet the requirements in paragraph AGGREGATES. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 160 degrees C when added to the aggregates. Modified asphalts shall be no more than 174 degrees C when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 175 degrees C when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet

mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A tack coat shall be applied in accordance with the contract specifications.

3.5 TEST SECTION

Prior to full production, the Contractor shall place a test section for each JMF used. The contractor shall construct a test section 75 - 150 m long and two paver passes wide placed for two lanes, with a longitudinal cold joint. The test section shall be of the same depth as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment and personnel used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. The test section shall be placed as part of the project pavement as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

One random sample shall be taken at the plant, triplicate specimens compacted, and tested for stability, flow, and laboratory air voids. A portion of the same sample shall be tested for aggregate gradation and asphalt content. Four randomly selected cores shall be taken from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D 3665. The test results shall be within the tolerances shown in Table 5 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If test results exceed the tolerances shown, the test section shall be removed and replaced at no cost to the Government and another test section shall be constructed. The test section shall be paid for with the first lot of paving

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
4.75 mm and larger	JMF plus or minus 8

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
2.36, 1.18, 0.60, and 0.30 mm	JMF plus or minus 6
0.15 and 0.075 mm	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	14 minimum
Stability, newtons (Average of 3 specimens)	8000 minimum
Flow, 0.25 mm (Average of 3 specimens)	8 - 16
Mat Density, Percent of Marshall (Average of 4 Random Cores)	97.0 - 100.5
Joint Density, Percent of Marshall (Average of 4 Random Cores)	95.5 - 100.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

3.6 TESTING LABORATORY

The laboratory used to develop the JMF shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 60 degrees C. To deliver mix to the paver, the Contractor shall use a material transfer vehicle which shall be operated to produce continuous forward motion of the paver.

3.7.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 3 m. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 300 mm; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3 m from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 3 m. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken,

mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint . The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 80 degrees C at the time of placing adjacent lanes), or otherwise defective, shall be cut back a minimum of 50 mm from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l.Surface Smoothness

3.10.2 Testing Laboratory

The Contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. The laboratory shall meet the requirements as required in ASTM D 3666. The effective working area of the laboratory shall be a minimum of 14 square meters with a ceiling height of not less than 2.3 m. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 24 degrees C plus or minus 2.3 degrees C. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D

2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.10.3.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.10.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 75 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

3.10.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.10.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, the Contractor shall establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 6, as a minimum. These control charts shall be posted as directed by the Contracting Officer and shall be kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, the Contractor shall take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, the Contractor shall halt production until the problem is solved. The Contractor shall use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Decisions concerning mix modifications shall be made based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action which shall be taken to bring the process into control when certain parameters exceed their Action Limits.

(Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Running Average of Individual Samples		Last Four Samples	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
4.75 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	6	8	4	5
0.6 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	4	6	3	4
0.075 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Stability, newtons (minimum)				
75 Blow JMF	8000	7560	8440	8000
50 Blow JMF	4450	4000	4900	4450
Flow, 0.25 mm				
75 Blow JMF	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
50 Blow JMF	8 min. 18 max.	7 min. 19 max.	9 min. 17 max.	8 min. 18 max
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment)			

3.11 MATERIAL ACCEPTANCE

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Test reports and payment calculations

shall be forwarded daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to 8 hours of production. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.11.1 Percent Payment

When a lot of material fails to meet the specification requirements for 100 percent pay as outlined in the following paragraphs, that lot shall be removed and replaced, or accepted at a reduced price which will be computed by multiplying the unit price by the lot's pay factor. The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, grade or smoothness (each discussed below). At the end of the project, an average of all lot pay factors will be calculated. If this average lot pay factor exceeds 95.0 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot's pay factor. For any lots which are less than 2000 metric tons , a weighted lot pay factor will be used to calculate the average lot pay factor.

3.11.2 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.3 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.4 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each lab compacted specimen using ASTM D 2726 and determining the

theoretical maximum density of every other sublot sample using ASTM D 2041. Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 7. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

3.11.5 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|/4

= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 7 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 7. Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, %
0.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

3.11.6 In-place Density

3.11.6.1 General Density Requirements

For determining in-place density, one random core will be taken by the Government from the mat (interior of the lane) of each sublot, and one random core will be taken from the joint (immediately over joint) of each sublot. Each random core will be full thickness of the layer being placed. When the random core is less than 25 mm thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying to a constant weight, cores obtained from the mat and from the joints will be used for in-place density determination.

3.11.6.2 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average Marshall density for the lot. The Marshall density for each lot will be determined as the average Marshall density of the four random

samples (3 specimens compacted per sample). The average in-place mat density and joint density for a lot are determined and compared with Table 8 to calculate a single pay factor per lot based on in-place density, as described below. First, a pay factor for both mat density and joint density are determined from Table 8. The area associated with the joint is then determined and will be considered to be 3 m wide times the length of completed longitudinal construction joint in the lot. This area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of hot-mix asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously. The area associated with the joint is expressed as a percentage of the total lot area. A weighted pay factor for the joint is determined based on this percentage (see example below). The pay factor for mat density and the weighted pay factor for joint density is compared and the lowest selected. This selected pay factor is the pay factor based on density for the lot. When the Marshall density on both sides of a longitudinal joint is different, the average of these two densities will be used as the Marshall density needed to calculate the percent joint density. All density results for a lot will be completed and reported within 24 hours after the construction of that lot.

Table 8. Pay Factor Based on In-place Density

Average Mat Density (4 Cores)	Pay Factor, %	Average Joint Density (4 Cores)
97.9 or 100	100.0	96.4 or above
97.8 or 100.1	99.9	96.3
97.7	99.8	96.2
97.6 or100.2	99.6	96.1
97.5	99.4	96.0
97.4 or 100.3	99.1	95.9
97.3	98.7	95.8
97.2 or 100.4	98.3	95.7
97.1	97.8	95.6
97.0 or 100.5	97.3	95.5
96.9	96.3	95.4
96.8 or 100.6	94.1	95.3
96.7	92.2	95.2
96.6 or 100.7	90.3	95.1
96.5	87.9	95.0
96.4 or 100.8	85.7	94.9
96.3	83.3	94.8
96.2 or 100.9	80.6	94.7
96.1	78.0	94.6
96.0 or 101.0	75.0	94.5
below 96.0or above 101.0	0.0 (reject)	below 94.5

3.11.6.3 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 97.2 percent (of

lab density). (2) Average joint density = 95.5 percent (of lab density). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 8:

Mat density of 97.2 percent = 98.3 pay factor.

Joint density of 95.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area (length of longitudinal joint x 10 ft) to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 10 ft. width and divide by the mat area (total paved area in the lot).

(2000 ft. x 10 ft.)/30000 sq.ft. = 0.6667 ratio of joint area to mat area (ratio).

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

wpf = joint pay factor + (100 - joint pay factor) (1 - ratio)
wpf = 97.3 + (100-97.3) (1-.6667) = 98.2%

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

Pay factor for mat density: 98.3%. Weighted pay factor for joint density: 98.2%

Select the smaller of the two values as pay factor based on density: 98.2%

3.11.7 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 15 mm from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 7.6 m , or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests. When more than 5 percent of all measurements made within a lot are outside the 15 mm tolerance, the pay factor based on grade for that lot will be 95 percent. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the

surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.8 Surface Smoothness

The Contractor shall use one of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 60 m in length and the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.8.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 6 mm or more, and all pavements shall be within the tolerances specified in Table 9 when checked with an approved 4 m straightedge.

Table 9. Straightedge Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Tolerance, mm
All paved areas	Longitudinal	6
	Transverse	6

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavement shall have a Profile Index not greater than specified in Table 10 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 60 m , that direction shall be tested by the straightedge method and shall meet requirements specified above.

Table 10. Profilograph Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Maximum Specified Profile Index (mm/km)
All Paved Areas	Longitudinal	140

3.11.8.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual

sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 8 m or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 6.1 m and at the third points for lanes 6.1 m or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

b. Profilograph Testing. Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 5 mm wide and the "bump template" shall span 25 mm with an offset of 10 mm. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

3.11.8.3 Payment Adjustment for Smoothness

a. Straightedge Testing. Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent of all measurements made within a lot exceed the tolerance specified in paragraph Smoothness Requirements above, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness, will be 95 percent. When more than 10.0 percent of all measurements exceed the tolerance, the computed pay factor will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed pay factor will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

b. Profilograph Testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph Smoothness Requirements above by 16 mm/km , but less than 32 mm/km, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 32 mm/km , but less than 47 mm/km, the computed pay factor will be 90 percent. When the Profile Index exceeds the tolerance by 47 mm/km , but less than 63 mm/km, the computed pay factor will be 75

percent. When the Profile Index exceeds the tolerance by 63 mm/km or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 79 mm/km or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas). Any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm in height shall be reduced by diamond grinding until they do not exceed 7.5 mm when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. At the Contractor's option, pavement areas, including ground areas, may be rechecked with the profilograph in order to record a lower Profile Index.

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SECTION 02748

BITUMINOUS TACK AND PRIME COATS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 40	(2002) Sampling Bituminous Materials

ASTM INTERNATIONAL (ASTM)

ASTM D 140	(2001) Sampling Bituminous Materials
ASTM D 2397	(2002) Cationic Emulsified Asphalt
ASTM D 2995	(1999) Determining Application Rate of Bituminous Distributors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Waybills and Delivery Tickets

Waybills and delivery tickets, during progress of the work.

SD-06 Test Reports

Sampling and Testing

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application.

PART 2 PRODUCTS

2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 2397 Grade CSS-1, CSS-1h, or CRS-1.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.20 liter nor more than 0.70 liter per square meter of pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.70 liter nor more than 1.80 liters per square meter of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

Emulsions	
CRS-1	52-85 degrees C
CSS-1	21-60 degrees C
SS-1h	21-60 degrees C

*These temperature ranges exceed the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the

equipment shall be permitted within 8 meters of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. All traffic, except for paving equipment used in constructing the surfacing, shall be prevented from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat shall conform to all requirements as described herein.

3.4.2 Prime Coat

The prime coat will be required if it will be at least seven days before a the surfacing (Asphalt cement hot mix concrete)layer is constructed on the underlying (base course, etc)compacted material. The type of liquid asphalt and application rate will be as specified herein. The Contractor shall protect the underlying from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Damage to the underlying material caused by lack of, or inadequate, protection shall be repaired (recompacted or replaced) by approved methods at no additional cost to the Government. If the Contractor options to use the prime coat, it shall be applied as soon as possible after consolidation of the underlying material. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

3.4.3 Tack Coat

Tack coat shall be applied at the locations shown on the drawings.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous material used shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous

materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 30 meters for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.20 liters per square meter . Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 1.10 liters per square meter . Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

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SECTION 02763

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952 (Rev D; Notice 1) Paint, Traffic and Airfield Marking, Waterborne (Metric)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Composition Requirements

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Qualifications

Documentation on personnel qualifications, as specified.

SD-06 Test Reports

Sampling and Testing

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.4.1 Paint Application Equipment

1.4.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 8 km/hour , and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.4.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.4.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.4.3 Surface Preparation Equipment

1.4.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 70.8 L/sec of air at a pressure of not less than 620 kPa at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.4.3.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa at 60 degrees C in order to adequately clean the surfaces to be marked.

1.4.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.4.5 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers.

Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.5 MAINTENANCE OF TRAFFIC

1.5.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.6 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 5 degrees C and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

1.7 QUALIFICATIONS

The Contractor shall submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of chemicals.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C and less than 35 degrees C . Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified . The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

b. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 2.9 plus or minus 0.5 square meter per liter .

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.3 MARKING REMOVAL

Pavement marking, including plastic tape, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

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SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 2000) Burlap Cloth made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2003) Slump of Hydraulic Cement Concrete
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(2003) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 309	(2003 Rev. A) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 5893	(1996) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The designation "ED" indicates review to be performed by the Designer, and "RE" indicates the review to be performed by the Resident Engineer. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete
Concrete Pattern; G: ED
Concrete Color; G: ED
Concrete Texture; G: ED

Copies of certified delivery tickets for all concrete used in the construction.

At least 30 days prior to the installation of the imprinted colored concrete pavement areas, the Contractor shall submit the type of system to be utilized. Included shall be the manufacturer's recommendations for installation.

SD-04 Samples

Imprinted Concrete Patterning Tool; G: RE
Materials and/or tools to be used for the construction of the imprinted colored pavement, including manufacturer's instructions for application, shall be submitted a minimum of 15 working days prior to their intended use on the project.

Concrete Paving Blocks; G: ED

A sample of five paving blocks of each size and color shall be submitted with Field Test Panels (paragraph 1.5). Color of blocks shall be approved by Designer and Contracting Officer to ensure a good match between Imprinted Colored pavement.

SD-06 Test Reports

Field Quality Control

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 5 degrees C and is falling, or is already below that point. Placement may begin when the air temperature reaches 2 degrees C and is rising, or is already above 5 degrees C . Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C , placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 10 and 30 degrees C . Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30 degrees C except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 35 degrees C at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.5 Field Test Panels

Field test panels shall be constructed prior to beginning of work using the materials and procedures proposed for use on the job, to demonstrate the results to be attained. The quality and appearance (color, texture,

pattern) of each panel shall be subject to the approval of the Designer and the Contracting Officer, and if not judged satisfactory, additional panels shall be constructed until approval is attained. Formed or finished surfaces in the completed structure shall match the quality and appearance of the approved field test panels.

An imprinted concrete sidewalk slab test panel, at least three meters by three meters in size and at thickness indicated, shall be constructed to demonstrate the imprinted sidewalk slab pattern, color, and texture. Panels shall be located as directed by the Contracting Officer. Each panel shall have a full length joint line.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 24 MPa at 28 days. Maximum size of aggregate shall be 37.5 mm .

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 50 mm plus or minus 25 mm where determined in accordance with ASTM C 143/C 143M.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 13 mm thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C 920 or ASTM D 5893.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 50 mm nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 3 m . Radius bends may be formed with 19 mm boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 3 m with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3

m or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

2.7 CONCRETE PATTERN, COLOR, AND TEXTURE

Where indicated on the contract drawings, the concrete sidewalks, patios, and equipment layout areas shall be patterned, colored, and textured as follows:

2.7.1 Sidewalk, Patio, and Equipment Layout Area Concrete Pattern

a. Where indicated on the drawings, the concrete pavement shall be an imprinted random pattern of variegated-size, slate-textured stone blocks and natural mortar joints. The pattern shall be Yorkstone by Patterned Concrete Industries, LTD., 1-800-252-4619; Courtyard Slate by Symons Corporation, 1-847-298-3200; Ashlar slate by Bomanite, 550-673-2411.or approved equal. Stone block sizes shall be a maximum of 900 mm x 900 mm and a minimum of 150 mm x 150 mm. Fifty percent of the total area shall consist of sizes 900 mm square, 750 mm square, and 750 mm x 900 mm rectangular. This approximates the pattern used in FY02 project at Echo Block. Note: the pattern at the Brigade on Echo Block shall match the pattern from the FY02 project at Echo Block.

b. Where indicated on the Brigade drawings, the concrete sidewalk shall be imprinted with a running bond brick or soldier course brick pattern as noted. The patterns shall be as available from the same manufacturers as listed above in para. a. or approved equal. Pattern, size and texture shall match brick patterns used in WBR FY02 and WBR FY03 projects at Echo Block.

2.7.2 Concrete Color for Patterned/Imprinted Concrete

Where indicated on the drawings, the concrete sidewalk shall be integrally-colored using an approved concrete dye. The pigmentation for integrally-colored concrete shall conform to ASTM C979. The color at the Brigade Building shall match the tan/light brick color of patterned concrete used for WBR FY02 and WBR FY03 projects at Echo Block. The color at Alpha Block shall be light gray such as Chromix Admixture for Color-Conditioned Concrete, color 3987 Porcelain Gray; or Bomanite, Seal Gray; or equal. Color of grout for Alpha Block shall match color of concrete. Colors of concrete pavements shall blend with color tones of concrete paving blocks described in Paragraph 2.9.

2.7.3 Imprinted/Patterned Concrete Texturing

Where indicated on the drawing, the imprinted concrete pavements shall be textured using a slate to match pattern description in Paragraph 2.7.1.a or brick texture to match pattern description in para. 2.7.1.b.

2.8 BEDDING AND JOINTING SAND

Two separate sand gradations shall be used for the bedding layer and in the block joints. Both sand gradations shall consist of crushed sand, natural sand, or a combination of crushed and natural sand. Both sand gradations shall have a minimum L.A. Abrasion of 40 percent when tested in accordance with ASTM C 131. Both sand gradations shall be nonplastic when tested in accordance with ASTM D 4318 and shall be free of lumps, clay, vegetation, soft particles, sulfates, and other contaminants. The bedding and jointing sands shall conform to the following gradations, determined in accordance with ASTM C 136 and ASTM C 117, using ASTM E 11sieve.

Sieve (ASTM E 11)	Percent Passing	
	Bedding Sand	Jointing Sand
9.5 mm	100	100
4.75 mm	80-100	100
2.36 mm	60-90	95-100
1.18 mm	25-70	70-100
0.600 mm	10-35	40-75
0.300 mm	5-20	10-40
0.150 mm	0-10	2-25
0.075 mm	0-5	0-10

2.9 CONCRETE PAVING BLOCK

The concrete paving block shall conform to ASTM C 936, and shall be approximately 41 mm to 64 mm thick. The concrete paving blocks shall be square, 600 mm x 600 mm or 450 mm x 450 mm as indicated on the drawings. Paving blocks at the Brigade building (Echo Block) shall be; Hydrapressed Slabs by Abbotsford; color "tan" to match WBR FY02 project at Echo Block. The concrete paving blocks at Alpha Block shall be Wausau Tile Type Three Cotillion FDX, color FDX2008 or FDX1009; or Hanover Architectural Products Prest Paver with tudor finish, color Limestone Gray or color Natural; or equal. Pigmentation for pavers shall conform to ASTM C 979. Color of concrete paving blocks and color of imprinted concrete sidewalks shall blend.

2.10 ADDITIONAL CONCRETE PAVING BLOCKS

In addition to the concrete paving blocks installed in the project, the Contractor shall provide an additional 10% of each type, color, size, etc. of concrete paving block utilized. The blocks shall be delivered on pallets to the area designated by the Contracting Officer's Representative for future use and repair.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted in conformance with Section 02300, EARTHWORK.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 1.2 m . Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 3 mm in any 3 m long section. After forms are set, grade and alignment shall be checked with a 3 m straightedge. Forms shall have a transverse slope of 20 mm per meter with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

Large areas of colored/patterned concrete shall be a continuous pour to ensure consistency in color and pattern.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 3 mm . Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 8 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm .

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float

until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 13 mm . Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 6 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm .

3.5 CONCRETE BLOCK PLACEMENT

3.5.1 Sand Bedding Layer

The bedding sand shall be spread evenly directly and shall be screeded to an average thickness as recommended by the manufacturer. This bedding sand shall not be used to fill low areas that exceed the specified tolerance for the base. The sand shall be lightly compacted and shall not be disturbed by any pedestrian or vehicle construction traffic. A layer of geotextile and gravel base course shall be provided under pavers, below sand bedding, in areas where no planting occurs and as detailed on the drawings.

3.5.2 Block Placement

The concrete paving blocks shall be placed by hand in the indicated pattern. Concrete paving patterns and layouts indicated on the drawings are approximate and shall be verified by the Contractor prior to installation. Placement of paving blocks shall start from a corner or straight edge and proceed forward over the undisturbed sand bedding. The joints or gaps between paving blocks shall be typically 150mm or as indicated on the drawings. Blocks shall be installed to receive river rock mulch or groundcover planting and bark mulch between concrete paving blocks as indicated on the drawings.

3.5.3 Unfilled Gaps

Any gaps between paving blocks and any sidewalk edge, drainage structures, or other members that cannot be filled with a whole block shall be filled with a paving block cut to fit the gap, except that slivers will not be allowed. The minimum size of triangular or odd-shaped cut block shall be 150mm on any one side. Cutting shall be done with a hydraulic splitter, a masonry saw, or other device that accurately leaves a clean, vertical face without spalling.

3.5.4 Seating Blocks

The concrete paving blocks shall be seated in the bedding sand by compacting them with a minimum of three passes of a vibratory plate compactor.

3.6 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 1.5 m on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 3 m or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.6.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.6.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 10 mm joint filler strips. Joint filler shall be placed with top edge 6 mm below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 3 mm, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.6.3 Reinforcement Steel Placement

Where indicated, reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is

placed.

3.7 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.7.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 1.5 m nor greater than 4.5 m in length. Contraction joints shall be constructed by means of 3 mm thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.7.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 10 mm in width shall be provided at intervals not less than 10 meters nor greater than 35 meters. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Expansion joints and the top 25 mm depth of curb and gutter contraction-joints shall be sealed with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.8 CURING AND PROTECTION

3.8.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.8.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 150 mm . The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.8.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm when a continuous sheet is not used. The curing medium shall not be less than 450 mm wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.8.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 5 square meters/L for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic,

except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.8.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.8.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.9 FIELD QUALITY CONTROL

3.9.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.9.2 Concrete Testing

3.9.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 190 cubic meters of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa .

3.9.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector.

If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.9.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 190 cubic meters , or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.9.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.9.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks. Colored/patterned concrete shall be uniform throughout the project. Areas of mismatched color and patterns shall be rejected, removed and replaced.

3.10 SURFACE DEFICIENCIES AND CORRECTIONS

3.10.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm the deficient section will be removed, between regularly scheduled joints, and replaced.

3.10.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 6 mm . Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.10.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government

and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

SECTION 02811

UNDERGROUND SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C901	(2002) Polyethylene (PE) Pressure Pipe and Tubing, 13mm through 76mm, for Water Service

ASME INTERNATIONAL (ASME)

ASME B1.2	(1983; R 2001) Gages and Gaging for Unified Inch Screw Threads
ASME B16.3	(1999) Malleable Iron Threaded Fittings 98'
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

ASTM INTERNATIONAL (ASTM)

ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASTM B 32	(2003) Solder Metal
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard

	Sizes
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(2003) Standard Classification System For Rubber Products In Automotive Applications
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(2002) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	(2001) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	(2003) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM F 441/F 441M	(1999e1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2002) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-51145 (Rev D) Flux, Soldering, Non-Electronic, Paste and Liquid

1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 414_kPa at connection to pump and240 kPa at the last head in each zone.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sprinkler System; G

Detail drawing for pump system. Drawings shall include a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, pump, electrical controls, controller, and mounting details of all hardware. As-built Drawings which provide current factual information showing locations of mains, heads, valves, pump system, and controller including deviations from and amendments to the drawings and changes in the work shall be included.

SD-03 Product Data

Framed Instructions; G

Labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Field Training; G

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules and notification of training.

Sprinkler System; G

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

Spare Parts; G

Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-06 Test Reports

Field Tests; G

Performance test reports, in booklet form, showing all field tests performed to adjust each component; and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

SD-07 Certificates

Sprinkler System; G

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

SD-10 Operation and Maintenance Data

Sprinkler System; G

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other

contaminants. Improperly stored material will be rejected and removed from the site immediately.

1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 TEST WATER CONDITIONS

The contractor shall check the pressure at the irrigation pump and confirm minimum operating pressure and flows are provided. In the event the water pressure does not meet the minimum and maximum operating pressure, notify the Contracting Officer and state conditions. Direction shall be provided.

1.7 INSTALLER QUALIFICATIONS

Engage a firm or firms specializing in irrigation installation. The field foreman shall have a minimum of 5 years experience with the installing firm and successfully completed at least three projects similar in material and scope to the work indicated for this project. The firm responsible for the installation shall have successfully completed at least three past projects similar in material and scope to this project including names and telephone numbers of owners/operators and date of project installation within the last two years.

1.8 WARRANTY

Warranty all work for a period of one year, starting on the date of final acceptance of the system(s), against defects in materials, equipment, workmanship, and any repairs required resulting from leaks or other defects of workmanship, materials, or equipment. During the warranty period, Contractor shall check, clean, and adjust sprinkler heads and other irrigation components as necessary to ensure adequate operation of the system.
Emergency repairs may be made by the Government without relieving the Irrigation Contractor of their warranty obligations.
Repair settling of backfilled trenches occurring during the warranty period, including restoration of damaged plantings, paving, and improvements resulting from settling of trenches or repair operations. Respond to Government's request for repair work within 1 week. If not, Contracting Office will proceed with such necessary repairs at the Contractors expense.

1.9 OPERATION AND MAINTENANCE PERIOD

The Contractor shall be responsible for the operation and maintenance of the entire irrigation system(s) installed under this contract for a period of one year starting on the date of final acceptance of the system(s). The one year operation and maintenance period for the irrigation system(s) shall coincide and be fully coordinated with the one year landscape maintenance period, see also Section 02935 Exterior Plant Material Maintenance.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced and marketed these products and which have performed well for a minimum period of 3 years on private and public projects prior to bid opening of this project. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Extra Stock

The following extra stock shall be provided: Five sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Copper Tubing and Associated Fittings

Tubing shall conform to requirements of , Type K. Fittings shall conform to ASME B16.22 and ASME B16.18, solder joint. Solder shall conform to ASTM B 32 95-5 tin-antimony. Flux shall conform to CID A-A-51145, Type I. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C . Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.2.2 Red Brass Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM B 43, regular. Fittings shall be Class 250, cast bronze threaded conforming to the requirements of ASME B16.15.

2.2.3 Galvanized Steel Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM A 53/A 53M, Schedule 40. Fittings shall be Class 150 conforming to requirements of ASME B16.3.

2.2.4 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.4.1 PVC Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 .

2.2.4.2 PVC Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded mainline fittings (male and female threads both) shall conform to requirements of ASTM D 2464, Schedule 80.

2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.5 Polyethylene (PE) Plastic Piping

Pipe shall conform to AWWA C901, outside diameter base with dimension ratio (DR) of 9.3 to provide 1034 kPa minimum pressure rating. Fittings shall conform to ASTM D 3261, DR of 9.3.

2.2.6 Dielectric Fittings

Dielectric fittings shall conform to ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 100 mm minimum length.

2.3 HEADS

2.3.1 Pop-Up Spray Heads

2.3.1.1 General Requirements

Pop-up spray heads lay flush with housing, then pop up when water pressure 138 kPa is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 100 mm (4 inches) above the body. The body shall be constructed with a 13 mm female thread for installation in a fixed underground pipe system.
Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent mounting on pop ups mounted nearly flush with finish grade Provide plastic nozzles. See plans for pop up heigths. 2.3.2 Rotary Pop-Up Sprinklers

Rotors shall be capable of covering 12,8 m diameter at 344 kPa with a distribution rate of 0,77 m3/hr 100 mm pop-up, and a trajectory of 25. Construction shall be high impact molded plastic with filter screen, reducible watering radius, availablend choice of a minimum of 12 nozzles and have adjustable radius capabilities.

2.4 VALVES

2.4.1 Gate Valves, Less than 80 mm

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

2.4.2 Angle Valves, Less Than 65 mm >

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150 threaded ends.

2.4.3 Quick Coupling Valvess

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

2.4.4 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 25-50 mm size, suitable for 24volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be plastic housing suitable for service at 1034 kPa operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.5 Drain Valves

2.4.5.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 65 mm and MSS SP-85, Type II, Class 250 threaded ends for sizes 65 mm and larger.

2.4.5.2 Automatic Valves

Automatic valves shall be plastic, spring loaded ball drip type, Class 150 and threaded ends, designed to close at 18 kPa pressure head with positive seal at 21 kPa pressure or greater and be open to drain at less than 21 kPa pressure.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 15 mm diameter by 1000 mm long, tee handles and keyed to fit valves.

2.5.2 Valve Boxes and Concrete Pads

2.5.2.1 Valve Boxes

Valve boxes shall be plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 130 mm

2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 115 mm dial, brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.5 Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover,wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 0 to 3 hours, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and a battery backup to retain programming in the case of a power outage.

2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Control wire for automatic valves must be insulated single strand copper design for 20 to 50 volts and U.L. approved as type U.F. U.L. designation shall be clearly marked or indented on the insulation jacket of the wire. Wire size shall be #14 unless noted otherwise.

2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 17 MPa at 28 days as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02510 WATER DISTRIBUTION SYSTEM.

2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02510 WATER DISTRIBUTION SYSTEM.

2.11 BEDDING FOR PIPE

Bedding for use in pipe and sprinkler head installation shall be clean imported sand conforming to the following:

Sand: 90-100 percent passing a 12.5 mm sieve: 65-100 percent passing a 6.3 mm sieve: 40-100 percent passing a 10-mesh sieve: 3-30 percent passing a 50-mesh sieve: 0-4 percent passing a 100 mesh sieve: and 0-3 percent passing a 200-mesh sieve.

2.12 RAIN SENSOR

Provide one rain sensor with an adjustable shut-off point 3.12 mm to 25 mm of accumulated rainfall. Provide a by-pass switch on controller housing to override sensor. Unit shall be UL approved. Acceptable manufacturers shall be Rainbird, Toro, Glen Hilton, Weathermatic or as approved.

2.13 DETECTABLE TAPE

Tape shall be blue color coded detectable marking tape 75 mm wide.

PART 3 EXECUTION

3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02300 EARTHWORK, except as modified herein.

3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 50 mm diameter or greater are encountered. Trench width shall be 200 mm minimum or 3 times diameter of pipe, whichever is wider to allow for import sand bedding. Backfill shall be hand tamped over excavation. Trench shall be excavated 100 mm deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade and approved by Quality Control Representative prior to installation of the pipe. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

3.1.2 Piping System

3.1.2.1 Cover

Underground piping shall be installed to meet the minimum depth of backfill cover specified.

3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 100 mm for pipe 50 mm and less; 150 mm for pipe 65 mm and larger. Minimum vertical clearances between lines shall be 150 mm. See Plate L-801, detail H.

3.1.3 Piping Installation

3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 5 degrees C.

d. Sizing of pipe is shown on the drawings and is for information only. Exact sizes shall be determined by the Irrigation Contractor based upon head/nozzle selection. Flows in piping shall not exceed 1.5 meters per second.

3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

3.1.3.3 Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of

dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02510 WATER DISTRIBUTION SYSTEM.

3.1.3.5 Detectable Tape

Detectable tape shall be provided directly above all main and lateral line piping. Tape shall be installed a minimum 300 mm below the finish grade and continuously imprinted with "Caution Water line Buried Below" using permanent black ink.

3.1.4 Installation of Valves

3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 100 mm cover measured from finish grade to top of valve stem.

3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 100 mm cover measured from grade to top of valve. Do not allow the valve box to rest directly on the piping.

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 0.03 cubic meter gravel. Gravel shall be covered with building paper then backfilled with excavated material . Install one manual drain at each point of connection and pump outlet.

3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain. All sprinkler heads shall be surrounded with sand bedding, 100 mm in all direction. Spray head shall be installed 150 mm away from adjacent hardscape and gear rotors shall be installed 300 mm away.

3.1.6 Control Wire and Conduit

3.1.6.1 Wires

Low voltage wires shall be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving or in areas not containing irrigation piping. One control circuit shall be provided for each zone and a common circuit to control sprinkler system. See plan notes for spare wire locations and general wire routing.

3.1.6.2 Loops

A 600 mm loop of wire shall be provided at each valve where controls are connected.

3.1.6.3 Expansion and Contraction

Control wires shall be bundled and taped together at 6 m intervals with 300 mm loop for expansion, contraction, and future repair. These loops shall be located at each end of sleeving and at every turn of direction for the wire..

3.1.6.4 Splices

Electrical splices shall be waterproof.

3.1.7 Automatic Controller

Exact approved field location of controllers shall be determined before installation. Coordinate the electrical service to this locationwith the electrical contractor. Install controller adjacent to its electrical service. Install in accordance with manufacturer's recommendations and NFPA 70. Coordinate pump start relay installation with Electrical.

3.1.8 Backfill

3.1.8.1 Minimum Cover

Depth of cover shall be 300 mm for pvc lateral pipe, ; 450 mm for mainline, 600 mm for pipes under traffic loads and hardscape,(sleeving);and 450_mm for low-voltage wires. Remainder of trench (after bedding) shall be filled to subgrade with excavated soil. Compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

3.1.8.2 Restoration

Top disturbed area shall be filled with topsoil and compacted with same density as surrounding soil. Lawns, plants and topsoil depth shall be restored and installed in accordance with Sections 02921 SEEDING and Section 02930 EXTERIOR PLANTING. Cutting of asphalt or concrete pavements will not be allowed.

3.1.9 Adjustment

After the landscape installation, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by adjusting the approved swing joint assembly which will permit adjustment in height and location of head without changing piping.

3.1.10 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.1.15 Winterizing the System

The irrigation system shall be winterized the first winter season (on or about November 1) following substantial completion of the project in total. The irrigation piping shall be winterized by first blowing the system clear of water using compressed air (550 kPa, maximum) admitted into the piping at a quick coupling valve or hose bib located at a higher elevation on the system piping. Activate individual zones, higher zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature from being injected directly into the PVC piping. One spring start up and one fall winterization is required for each independent system after final completion. Spring start-up should occur on or about March 1. Schedule and coordinate spring start-up with Fort Lewis Public Works maintenance personnel (contact available from the Contracting Officer).

3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 1034 kPa without pumping for a period of one hour with an allowable pressure drop of 35 kPa If hydrostatic pressure cannot be held within this requirement, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer. Do not cover any associated piping until the acceptance of this test.

3.2.2 Leakage Tests

Leakage tests for service main shall be in accordance with Section 02510 WATER DISTRIBUTION SYSTEM.

3.2.3 Operation Test

At conclusion of pressure test, sprinkler heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.3 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart

and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 0.505 mm pieces of clear plastic.

3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 4 hours minimum of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed off site immediately.

3.6 AS-BUILT DRAWINGS

The Contractor is responsible for documenting changes to the design which occur during construction. Any changes in the layout and/or arrangement of the proposed irrigation system, or any other differences between the proposed system and actual installed conditions area to be recorded by the Irrigation Contractor in the form of an 'As-built' drawing. One copy of the final design submittal drawings provided by the Contractor are to be used as the base for recording as-built information. As-built drawings are to be clearly and neatly drawn and shall be submitted in accordance with the fronts portion of this project specification. All automatic and manual valves, hose bibs or quick couplers, and wire splice locations shall be shown with actual dimensions to reference points so they may be easily located in the field. All location of sprinkler heads, backflow preventers, and controllers shall be approximate. These documents must be available for inspection by the Contracting Officer throughout the construction period. The routing of buried of concealed piping must be given at least two permanent reference points, of each irrigation system valve, each sleeve and conduit end, pipe or wire stub-out, and other irrigation components enclosed within a valve box. Record these dimensions on the drawings for as-built purposes. Clarify or change the documents in accordance with the Contracting Officer's instructions at no additional cost to the Government.

3.7 OPERATION AND MAINTENANCE PERIOD

Contractor shall be responsible for maintenance and operation of the newly installed irrigation system(s) for a period of one year from final acceptance of the installed system. At the discretion of the Contracting Officer, final acceptance may be divided into areas based on points of connection to the water source for each irrigation system. Irrigation maintenance and operation shall be well-coordinated with maintenance of all turf and planting areas. See also Specification Section 02935 Exterior Plants Material Maintenance for detailed maintenance requirements.

3.8 OPERATION AND MAINTENANCE MANUALS

Complete operation and maintenance manuals shall be provided by the Contractor. Manuals shall provide step-by-step procedures required for system start-up, operation and shut-down. The manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Manuals shall list routine maintenance procedures and trouble shooting guides. Manuals shall include one scaled copy of as-built drawings of the systems installed for easy reference and a recommended programming schedule for each automatic controller.

-- End of Section --

SECTION 02821

FENCING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(2001) Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM C 94/C 94M	(2003a) Ready-Mixed Concrete
ASTM F 1043	(2000) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997; R 2003) Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(2003) Industrial and Commercial Horizontal Slide Gates
ASTM F 668	(1999a) Poly(Vinyl Chloride) (PVC) and other Organic Polymer-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1997) Padlocks
ASTM F 900	(2003) Industrial and Commercial Swing Gates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Chain Link Fence; ,

Statement, signed by an official authorized to certify on behalf of the manufacturer, attesting that the chain link fence and component materials meet the specified requirements.

PART 2 PRODUCTS

2.1 FENCE FABRIC

Fence fabric shall conform to the following:

2.1.1 Chain Link Fence Fabric

Class 2b polyvinyl chloride-coated steel fabric with 92 grams of zinc coating per square meter in accordance with ASTM F 668. Fabric shall be fabricated of 9 gauge wire woven in 50 mm mesh. Polyvinyl chloride coating for fabric and all other fence components shall be manufacturer's standard black in color. Fabric height shall be 1.8 m . Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.2 GATES

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate frames shall be polyvinyl chloride-coated steel pipe (Group IA)(Group IC) with external coating Type A, a nominal pipe size ()NPS) 1-1/2, conforming to ASTM F 1043. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 2.44 m wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Polyvinyl chloride coating for fabric and all other gate components shall be manufacturer's standard black in color.Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position.

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II , roll-formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184. Polyvinyl chloride coating for posts and all other post components shall be manufacturer's standard black in color.

2.4 BRACES AND RAILS

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Braces and rails shall be Group IC, steel pipe, size NPS 1-1/4 or Group II,formed steel sections, size 42 mm (1-21/32 inch) and shall be zinc coated (Type A) and polyvinyl chloride-coated conforming to the requirements of ASTM F 1043. Group II, formed steel sections, size 42 mm (1-21/32 inch) , conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished. Polyvinyl chloride coating for braces and rails and all other brace and rail components shall be manufacturer's standard black in color.

2.5 WIRE

2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.6 CONCRETE

ASTM C 94/C 94M, using 19 mm maximum size aggregate, and having minimum compressive strength of 21 MPa at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.7 PADLOCKS

Padlocks shall conform to ASTM F 883, Type , Size 44 mm (1-3/4 inch) . All padlocks shall be keyed alike. All padlocks shall be keyed to match Fort Lewis Public Works master key system for storm sewer utilities.

PART 3 EXECUTION

3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 3 m (10 feet) . Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not

exceed 152.4 m (500 feet) . Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 50 mm clearance between the bottom of the fabric and finish grade.

3.3 POST INSTALLATION

-- End of Section --

SECTION 02870

SITE FURNISHINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications shall be referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 48M	(2000) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(2001) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 615/A 615M	(2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 108	(2003a) Aluminum-Alloy Permanent Mold Castings
ASTM C 150	(2002ae1) Portland Cement
ASTM D 648	(2004) Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
ASTM D 2990	(2001) Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM F 1487	(2001e1) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings G.

Site Furnishing Standards;

Drawings showing scaled details of proposed site furnishings, elevations for each type of site furnishing; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction for the following:

- Benches
- Bike Rack
- Trash Receptacle

SD-03 Product Data

Site Furnishings; G

Manufacturer's descriptive data and catalog cuts.

Installation;

Manufacturer's installation and maintenance instructions.

SD-04 Samples

Finish;

Two sets of color data for each furnishing displaying manufacturer's color selections and finishes, and identifying those colors and finishes proposed for use.

SD-06 Test Reports

Recycled Material;

A report of site furnishing parts consisting of recycled materials. Product specification data shall provide test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component, shall be submitted. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, handled, and stored in accordance with the

manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.4 INSPECTION

Site furnishings shall be inspected upon arrival at the job site for conformity to specifications and quality in accordance with paragraph MATERIALS. Unacceptable items shall be removed from the job site.

PART 2 PRODUCTS

2.1 Concrete

Portland cement shall conform to ASTM C 150 Types I, II, or III.

2.1.1 Cast-in-Place Concrete

Cast-in-place concrete materials and products shall conform to Section 03330 CAST-IN-PLACE ARCHITECTURAL CONCRETE.

2.1.2 Masonry

Masonry material and products shall conform to Section 04200 MASONRY.

2.1.3 Metal

Metallic materials and products shall conform to Section 05500 MISCELLANEOUS METAL. Metal components shall be furnished with factory drilled holes. Components shall be free of excess weld and spatter. Metal components with holes that will not be filled by hardware or hidden by other components will be rejected.

2.1.3.1 Steel

Structural steel products shall conform to ASTM A 36/A 36M, ASTM A 500 and ASTM A 501.

2.1.3.2 Reinforcing Steel

Steel used for reinforcement shall be deformed billet steel Grade 40. Steel shall conform to ASTM A 615/A 615M.

2.1.3.3 Cast Iron

Cast iron shall conform to ASTM A 48M Class 35 or better. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting.

2.1.3.4 Cast Aluminum

Cast aluminum shall conform to ASTM B 26/B 26M and ASTM B 108. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall

be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting.

2.1.3.5 Bronze, Copper and Other Ounce Metals

Bronze, copper, and other ounce metals shall conform to ASTM B 62.

2.1.4 Wood

The Contractor shall provide premium grade wood free of knots; boards with eased edges and ends; and wood components with factory drilled holes. Components with holes that will not be filled by hardware or hidden by other components will be rejected.

2.1.4.1 Treatment

Wood that is not naturally rot and insect resistant shall be treated with standard procedures. Creosote, pentachlorophenol, tributyl tin oxide shall not be used in conformance with ASTM F 1487. Ammonium Copper Quat (ACQ) shall not be used for surfaces likely to contact the skin of small children.

2.1.4.2 Selection

Wood products shall be selected to withstand the climatic conditions of the region in which the site is located.

2.1.5 Recycled Material

2.1.5.1 General Requirements

Recycled materials shall contain a minimum 85 percent recycled post-consumer product. Recycled materials shall be constructed or manufactured with a maximum 6 mm deflection or creep in any member in conformance with ASTM D 648 and ASTM D 2990.

2.1.5.2 High Density Polyethylene

The Contractor shall provide panels and components molded of ultraviolet (UV) and color stabilized polyethylene, with minimum 6 mm wall thickness; exposed edges shall be smoothed, rounded, and free of burrs and points; and the material shall be resistant to fading, cracking, fogging, and shattering. The material shall be non-toxic and have no discernible contaminates such as paper, foil, or wood. The material shall contain no more than 3 percent air voids. Material shall be resistant to deformation from solar radiation heat gain.

2.1.5.3 Structural Component

Recycled materials to include plastic lumber will not be used as structural components of site furnishings.

2.1.6 Fiberglass

Fiberglass shall consist of at least 3 laminations of chopped glass fibers impregnated with polyester resin, with colors and textures molded into all exposed surfaces so that colors resist fading. Fiberglass shall be resistant to cleaners, fertilizers, high power spray and salt.

2.2 TRASH RECEPTACLE

Trash receptacle shall be a 121 L-size, approx. 675 mm diameter and 750 mm high. Receptacle shall be constructed of 10 gauge steel frame, Plastisol coated, with a dome top lid for all-weather protection. All other steel framework shall be coated with a baked on polyester dry powder. All hardware shall be stainless steel. The receptacle exterior shall be a rib pattern or design. The insert receptacle shall come standard with a liner and adjustable glides. The receptacle shall include a surface mount post package for permanent installation. The receptacle, frame, and dome lid shall be provided in the color black. Receptacle shall be Model LR300R and dome lid Model DT100N by Wabash Valley Manufacturing, Inc., 1-800-253-8619 or approved equal. Trash Receptacles shall be the same pattern/type and manufacturer as Bench 'A' and Bench 'B' Trash receptacles at the Brigade site shall match manufacturer and model at FY02 and FY03 WBR projects at Echo Block (Wabash as noted above).2.2.1 Coatings

2.2.1.1 Galvanizing

Galvanized components shall be hot-dipped in zinc after fabrication in accordance with ASTM A 123/A 123M. Tailings and sharp protrusions formed as a result of the hot-dip process shall be removed and exposed edges burnished.

2.2.1.2 Polyester Powder

Powder-coated surfaces shall receive electrostatic zinc coating prior to painting. Powder coating shall be electrostatically applied and oven cured. Polyester powder coating shall be resistant to ultraviolet (UV) light.

2.2.1.3 Polyvinyl-chloride (PVC)

PVC coating shall be primed with a clear acrylic thermosetting solution. The primed parts shall be preheated prior to dipping. The liquid polyvinyl chloride shall be ultraviolet (UV) stabilized and mold-resistant. The coated parts shall be cured. The coating shall be a minimum 2 mm thick plus or minus 0.5 mm and shall have an 85 durometer hardness with a slip-resistant finish.

2.2.2 Wood Sealants

Exposed wood surfaces shall have, as a minimum, two shop coats of paint, varnish, sealer, or other approved preservative. Sealants shall seal all applied surfaces from air.

2.2.3 Paint

Paint shall be factory applied with a minimum of 2 coats. Paint shall be

weather-resistant and resistant to cracking, peeling and fading.

2.2.4 Color

Color of site furnishing components shall be in accordance with Section 09915 COLOR SCHEDULE.

2.3 Benches

Bench types shall be provided as noted on drawings.

a. Bench shall be 1.8 m long with a back, constructed of 10 gauge sheet steel, rib pattern and coated with 6.3 mm of Plastisol. Bench legs shall be made from cast aluminum with surface mount for permanent installation. Plastisol and frame color shall be black. Bench shall be Model CY420R by Wabash Valley Manufacturing, Inc., or approved equal.

2.4 BIKE RACK

EXPO 'W' Series by Cora Bike Rack, Inc. or approved equal. Bike rack shall be constructed of heavy-duty quality steels. Mainframe shall be 59.5 mm OD and hangers shall be 19 mm minimum diameter round bars. Bike rack shall include all flanges and hardware for surface mounting and permanent installation. Mainframe and hanger finish shall be black powder coated or black plastic color coated carbon steel. Bike sizes (capacity) shall be provided as noted on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings. Site furnishings shall be installed plumb and true (level)in accordance with the approved manufacturer's instructions at the Contractor's expense. All site furnishings that are surface mounted, shall have base to concrete surface grouted. Use colored grout to match concrete if applicable.

3.1.1 Testing

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure: The Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing shall be provided.

3.1.2 Application of Field Finishes

Field painting shall not be allowed.

3.1.3 Parts

New parts shall be acquired from the manufacturer. Substitute parts will not be accepted unless approved by the manufacturer.

3.1.4 Assembly

When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. The Contractor is responsible for all costs associated with leveling site furnishings so that the installation is visually and structurally complete. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

3.1.5 Testing

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer''s recommendations and by the following procedure: The Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer''s recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing shall be provided.

3.1.6 Steel Frame

Tube steel used for sign mounting frame and fabrication shall conform to AISC requirements. All welded connections shall be performed in accordance with AWS D1.1 Structural Welding Code. Also see Section 05120 Structural Steel and Section 05500 Miscellaneous Metal. All screws, bolts, and anchors shall be hot-dip galvanized in accordance with ASTM A 123. All steel frames for signs shall be painted with an alkyd chrome oxide metal primer and finished with semigloss alkyd enamel paint. Color-black.

3.2 RESTORATION AND CLEAN UP

When the installation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the installation operation shall be restored to original condition at Contractor's expense.

3.2.1 Clean Up

The site shall be cleaned of all materials associated with the installation. Site furnishing surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be according to manufacturer's instructions or as indicated. Damaged plant material shall be replaced by the Contractor at their expense.

3.2.2 Protection

The area shall be protected as required or directed by providing barricades and signage.

3.2.3 Disposal of Materials

Excess and waste material shall be removed and disposed off Government property at Contractor's expense.

3.3 RE-INSTALLATION

Where re-installation is required, the following shall be accomplished:

a. Re-install the product as specified. Material acquisition of replacement parts is the responsibility of the Contractor. Provide replacement materials that are new and supplied by the original manufacturer to match.

b. Damage caused by the failed installation shall be repaired.

-- End of Section --

SECTION 02921

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a; R 2001) Agricultural Liming Materials
ASTM D 4972	(2001) pH of Soils
ASTM D 5268	(1992; R 1997) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;
Surface Erosion Control Material;
Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

A listing of equipment to be used for the seeding operation.

Delivery;

Delivery schedule.

Finished Grade and Topsoil;G

Finished grade status.

Subgrade and Topsoil; G

Delivered subgrade and topsoil

Quantity Check;

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period;

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record;G

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide;G

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;G

Samples taken from several locations at the source.

Soil Amendments;G

A 4.5 kg sample.

Mulch;G

A 4.5 kg sample.

SD-06 Test Reports

Equipment Calibration;

Certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Tests;G

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.Soil test lab shall participate in North American Proficiency Testing Program (NAPT). See internet site http://css.swu.edu/soil_Testing_Labs.htm for a list of participating Pacific Northwest labs.

SD-07 Certificates

Seed;G
Topsoil;G
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Mulch;G
Asphalt Adhesive;
Pesticide; G

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Mulch: Composition and source.

h. Asphalt Adhesive: Composition.

i. Pesticide. EPA registration number and registered uses.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered/Imported Topsoil

Prior to the delivery of any imported topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site (one soil test per source/manufacturer). Random soil tests may be requested by the Contracting Officer during the installation period if installed topsoil does not appear to meet specifications. All topsoil tests shall be provided by the Contractor at Contractor's expense. For bidding purposes, include six (6) topsoil tests. For random topsoil testing, the Contracting Officer shall select the soil sample at random planting beds and turf areas. If topsoil test reveals negative results, additional topsoil tests shall be conducted by the Contractor at Contractor's expense in adjacent plant beds/areas to verify topsoil makeup in those locations. Any topsoil that does not meet specifications, shall (at Contractor's expense), be immediately removed and replaced with topsoil that meets specifications.

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.3 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 19 mm diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed

from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight as follows:

Botanical Name	Common Name	Mixture Percent by Weight	% Germination
SEED MIX (fine lawn)			
Lolium perenne three-way sports blend of improved varieties)	Turf-type Perennial Ryegrass	33% each	90%
SEED MIX ' (perimeter/disturbed areas seed)			
Festuca trachy-phylla	Hard Fescue	33.33%	85%
Festuca ovina L.	Sheep Fescue	33.33%	81%

Festuca rubra L.	Red Fescue	33.33%	90%

2.1.3 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture and shall be free of restricted or prohibited noxious weed seed. The seed shall also be free of crop seed, and inert matter shall not exceed 3% by weight of the total mixture.

2.1.4 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.5 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Delivered topsoil shall meet the following requirements:

Topsoil shall be sandy loam as described by USDA soil texture classification. Sandy loam shall consist largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall fall apart when the pressure is released: on squeezing when moist,it shall form a cast that will not only hold its shape when the pressure is released, but shall withstand careful handling without breaking. Topsoil shall meet the following sieve requirements:

Screen Size	Percent Retained	Percent Passing
3/8 inch (9.52 mm)	0	100
#4(4.76mm)	5	95
#10 (1.68mm)	15	85
#30 (0.595)	30	70
#60 (0.250)	50	50
#100 (0.149)	70	30
#200 (0.063)	75	25
#270 (0.053)	85	15

Topsoil shall contain 5-7% organic content dry weight for turf areas, and 10-15% organic content by dry weight for planting beds. Dry weight shall be determined by a "loss on ignition" test. Organic matter shall be mixed, composted, fine-particle organic matter. Topsoil shall be obtained from well-drained areas and shall not contain more than 5 percent water by volume. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 19 mm diameter.

Topsoil shall be free from viable plants or plant parts,(including but not limited to Horsetail), and toxic substances or any other material that may be harmful to plant growth. The source of the organic matter shall have a carbon to nitrogen ratio below 25:1. The pH shall be between 5.5 and 7.5. Soluble salts shall not exceed 500 ppm. Each topsoil source shall be accompanied by a guaranteed statement of analysis listing the percent of organic matter and the pH. Delivered topsoil not conforming to these specifications shall be removed in its entirety, and replaced with approved topsoil at no additional cost to the Government.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite and peat shall not be used. Amendments shall be added as determined by soil test for types of plant materials specified.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.250 mm sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.250 mm sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.250 mm sieve.

2.3.2 Fertilizer

Fertilizer shall be as recommended by the soil test. For purposes of bidding the nutrients ratio shall be 12 percent nitrogen, 4 percent phosphorus, and 8 percent potassium. Fertilizer for fine lawn shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.3.3 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.3.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be supplied from a permitted compost facility in Washington State. Compost shall be in compliance with Washington State Department of Ecology Interim Guidelines for Compost Quality, Grade A/WAC Chapter 173-350 Section 220. Compost shall have a carbon to nitrogen ratio below 25:1. Compost shall have an organic matter content of 35% to 65% as determined by "loss of ignition" test method. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 7.5, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length.

2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

2.3.4 Soil Conditioner

Soil conditioner shall be sand or gypsum for use singly or in combination to meet the requirements of the soil test.

2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.4.2 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.4.3 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

2.4.1 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.4.2 Paper Fiber

Paper fiber mulch shall be recycled newsprint that is shredded for the purpose of mulching seed for hydroseeding applications.

2.5 WATER

Water will be furnished by the Government by the newly installed FY05 Chapel irrigation system. Contractor is responsible to water erosion control areas to establish an acceptable grass cover. Watering trucks (if needed) shall be supplied by the Contractor at their expense. Water will be Government-furnished. Watering trucks shall be filled at locations as directed by the Contracting Officer. Optional irrigation area in the parking lot shall also require manual watering if this option is not awarded.

2.6 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.7 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.7.1 Hydrophilic Colloids (Tackifier)

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

Seed shall be installed from 1 APR to 30 JUN for spring establishment; from 15 AUG to 01 OCT for fall establishment.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, excessive heat (above 26 degrees C), cold (below 1.6 degrees C), or other unsatisfactory conditions prevail, the work shall be stopped when directed. Late spring or summer seeding is not recommended. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval. Even if approved, if the Contractor conducts seeding operations outside the seeding times listed above or under unseasonable conditions, they do so without additional compensation and by accepting FULL responsibility for any subsequent, resulting losses.

3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

3.1.4 Soil Test

Delivered topsoil and excavated pit soil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size (sieve analysis), pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection for existing excavated soil shall be random over the entire site. Sample collection for delivered topsoil shall be at different levels in the topsoil pile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments, including fertilizer, pH adjuster, and soil conditioner, required to meet local growing conditions for the seed species specified.

3.2 SITE PREPARATION

3.2.1 Subgrade and Topsoil

The Contractor shall verify that subgrades are as indicated on drawings, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the seeding operation. Do not spread topsoil or soil amendment when frozen or excessively wet or dry. Topsoil placement shall be smooth, even, and blend to adjacent existing grades. Protect all topsoiled areas from damage by vehicular or pedestrian traffic.

Fine Lawn Areas: Spread topsoil evenly to a minimum compacted depth of 150 mm except as follows: areas within dripline of existing trees shall have a compacted depth of 50 mm of topsoil. Smoothly blend adjacent areas with topsoil to meet adjacent grades. Remove all rocks over 13 mm and provide a smooth, even surface to achieve finish grade. No topsoil is required in the erosion control areas.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied as recommended by the soil test. The pH adjuster shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage operation. For bidding purposes, include 18 kg/93 square meters (40 lbs/1000 sq.ft.).

3.2.2.2 Applying Fertilizer

The fertilizer shall be applied as recommended by the soil test. Fertilizer shall be incorporated as part of the hydroseeding operation. For bidding purposes, include 6.8 kg/93 sq. meters (15 lbs/1000 sq. ft.)

3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by the soil test. The soil conditioner shall be spread uniformly over the soil and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth. For bidding purposes, include total depth of 25 mm consisting of equal parts of conditioner as specified in the product part of this specification.

3.2.3 Prepared Surface

3.2.3.1 Preparation

The prepared surface shall be a maximum 25 mm and a minimum of 13 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

3.2.3.2 Lawn Area Debris and Weeds

Debris and stones over a minimum 13 mm in any dimension shall be removed from the surface. All weeds shall be removed from all areas prior to hydroseeding. Pesticide use shall be limited within the dripline of existing trees to limit damage to tree root systems. Weeds within this area shall be removed by hand or by using Glyphosate directly sprayed on individual weed (no broadcast spraying).

3.2.3.3 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Installing Seed

Seeding method shall be Hydroseeding. Seeding procedure shall ensure even coverage. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

3.3.2 Hydroseeding

Fine lawn seed shall be mixed to ensure broadcast at the rate of 342 kilograms per hectare (305 lb/acre). Erosion control areas shall be mixed to ensure broadcast at the rate of 90 kilograms per hectare (80 lb/acre). Seed and fertilizer shall be added to water and thoroughly mixed at the rates specified. Wood cellulose fiber mulch and/or paper fiber mulchshall be added at the rates recommended by the manufacturer after the seed, fertilizer and water have been thoroughly mixed, to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

Do not hydroseed within the required mulch circle area for existing trees. Existing trees located in turf areas shall receive a mulch circle covering the following area: 1) in an area equal to a 6.1-meter diameter circle around the tree trunk, or 2)if the tree's dripline is less than 6.1 meters, the mulch area shall equal the dripline of the tree. The dripline is defined as the circle drawn on the soil around a tree directly under its outermost branch tips. The mulch layer shall be 75 mm deep. See Section 02930 Exterior Planting for mulch material requirements.

3.3.3 Mulching

3.3.3.1 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.3.3.2 Wood Cellulose Fiber and Paper Fiber

Wood cellulose fiber and paper fiber shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations. Care shall be taken to apply recycled paper fiber at hydroseeding rates, not hydromulching rates to avoid creating mulch that forms an impenetrable crust.

3.3.4 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 25 mm depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the Installation Pest Management Coordinator.

3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.6.2 Application

A Washington State licensed applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide

label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding and topsoiling operations shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 Turf Maintenance Prior to Plant Establishment

Maintenance of turf shall begin immediately following seeding operation and shall extend to the end of the Seed Establishment Period. Maintenance includes but is not limited to: watering, weeding, mowing, fertilizing, repairing damaged or non-healthy areas, and other operations required to maintain a healthy stand of grass. See specific turf maintenance requirements in Section 02935 Exterior Plant Material Maintenance.

3.10 SEED ESTABLISHMENT PERIOD

3.10.1 Commencement

See 02935 EXTERIOR PLANT MATERIAL MAINTENANCE for turf maintenance and acceptance requirements. The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 12 months after the last day of the seeding operation. Written calendar time period shall be furnished for the seed establishment period. The seed establishment period shall be coordinated with Sections 02930 EXTERIOR PLANTING. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas if applicable.

-- End of Section --

SECTION 02922

SODDING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;
Chemical Treatment Material;

A listing of equipment to be used for the sodding operation. Manufacturer's literature including physical characteristics, application and installation instructions for equipment and chemical treatment material.

Delivery; G

Delivery schedule.

Finished Grade and Topsoil; G

Finished grade status.

Quantity Check; G

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed. The quantity of sod used shall be compared against the total area installed.

Sod Establishment Period; G

Calendar time period for the sod establishment period. When there is more than one sod establishment period, the boundaries of the sodded area covered for each period shall be described.

Maintenance Record; G

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; G

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil; G

Samples taken from several locations at the source.

Soil Amendments; G

A 4.5 kg sample.

SD-06 Test Reports

Equipment Calibration;

Certification of calibration tests conducted on the equipment used in the sodding operation.

Soil Test; G

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Sod; G
Topsoil; G
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Pesticide; G
Mulch G;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Sod. Classification, botanical name, common name, mixture percentage of species, percent purity, quality grade, field location and state certification.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Pesticide. EPA registration number and registered uses.

h. Mulch: Composition and source.

1.2 SOURCE INSPECTION

The sources of sod material and delivered topsoil shall be subject to inspection.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.3.1.1 Sod

Sod shall be protected during delivery to prevent desiccation, internal heat buildup, or contamination.

1.3.1.2 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

1.3.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.3.1.4 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.3.2 Inspection

Sod shall be inspected upon arrival at the job site for conformity to species. Sod shall be checked for visible broadleaf weeds, and a visible consistency with no obvious patches of foreign grasses that exceed 2 percent of the canopy. Sod that is heating up, dry, moldy, yellow, irregularly shaped, torn, or of uneven thickness shall be rejected. Topsoil and soil amendments shall meet requirements specified in Spec. Section 02921 Seeding. Other materials shall be inspected for compliance with specified requirements. Open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 13 mm diameter; and topsoil that contains viable plants and plant parts, shall be rejected. Unacceptable materials shall be removed from the job site.

1.3.3 Storage

1.3.3.1 Sod

Sod shall be stored in designated areas and kept in a moist condition by watering with a fine mist, and covered with moist burlap, straw, or other covering. Covering shall allow air to circulate, preventing internal heat from building up. Sod shall be protected from exposure to wind and direct sunlight until installed. See Spec. Section 02921 for seed species.

1.3.3.2 Other Material Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations, away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with sod operation materials.

1.3.4 Handling

Sod shall not be damaged during handling. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.3.5 Time Limitation

Time limitation between harvesting and installing sod shall be a maximum 36 hours.

PART 2 PRODUCTS

2.1 SOD

2.1.1 Sod Classification

Nursery-grown sod shall be provided as classified by applicable state laws. Sod section shall be sized to permit rolling and lifting without breaking. See Specification SECTION: 02921 SEEDING, for grass species.

2.1.2 Quality

Sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 25 mm in

diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the sod section. Sod shall be free of restricted and prohibited noxious weeds.

2.1.3 Thickness

Sod shall be machine cut to a minimum 35 mm thickness. Measurement for thickness shall exclude top growth and thatch.

2.1.4 Anchors

Sod anchors shall be as recommended by the sod supplier.

2.1.5 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil and all soil preparation and finish grading shall be as defined in Specification SECTION: 02921 SEEDING.

2.3 SOIL AMENDMENTS

Soil amendments shall be as defined in Section 02921 Seeding.

2.4 WATER

Water will be furnished by the Government via the newly contractor installed irrigation system.

2.5 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

PART 3 EXECUTION

3.1 INSTALLING SOD TIME AND CONDITIONS

3.1.1 Sodding Time

Sod shall be installed in all fine lawn areas if installation od lawn occurs between 1 November and 1 April at no additional cost to the Government.

3.1.2 Sodding Conditions

Sodding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other

unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the sodding operations, proposed alternate times shall be submitted for approval. Even if approved, if the Contractor conducts sodding operations outside the sodding times listed above or under unseasonable conditions, they do so without additional compensation and by accepting FULL responsibility for any subsequent, resulting losses.

3.1.3 Soil Test

See Section 02921 Seeding, paragraph 3.1.4 Soil Test for requirements.

3.2 SITE PREPARATION

3.2.1 Subgrade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that subgrades are as indicated on drawings; smooth grading and compaction requirements have been completed in accordance with Section 02300 EARTHWORK. Application of topsoil, and soil amendments shall be as indicated in Section 02921 Seeding. If subgrade is compacted or impermeable, scarify, disk or harrow or other approved method to a minimum depth of 150 mm. Remove all rocks over 25 mm and provide a smooth, even surface to achieve finish grade.

3.2.2 Prepared Surface

3.2.2.1 Preparation

The prepared surface shall be a maximum 25 mm and a minimum of 13 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be rolled and completed with a light raking to remove from the surface debris and stones over a minimum 13 mm in any dimension.

All weeds shall be removed from lawn areas prior to sodding. Pesticide use shall be limited within the dripline of existing trees to limit damage to tree root systems. Weeds shall be removed by hand or by using Glyphosate directly sprayed on individual weed (no broadcast spraying.

3.2.2.2 Protection

Areas within the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing sod, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Areas shall be sodded as indicated. Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be sodded and wetting the soil to a maximum 25 mm depth.

3.3.1 Installing Sod

Rows of sod sections shall be placed parallel to and tightly against each other. Joints shall be staggered laterally. The sod sections shall not be stretched or overlapped. All joints shall be butted tight. Voids and air drying of roots shall be prevented. Sod sections shall be laid across the slope on long slopes. Sod sections shall be laid at right angles to the flow of water in ditches. Sod sections shall be anchored on slopes steeper than 3-horizontal-to-1-vertical. Anchoring may be required when surface weight or pressure upon placed sod sections is anticipated to cause lateral movement. Sod anchors shall be placed a minimum 600 mm on center with a minimum 2 anchors per sod section.

3.3.2 Finishing

Displacement of the sod shall be prevented by tamping or rolling the sod in place and knitting the sod to the soil. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed, and holes or missing corners shall be patched with sod.

3.3.3 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter roller width on the same day as the sod is installed. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

3.3.4 Watering Sod

Watering shall be started immediately after completing each day of installing sod. The first week, sod shall be kept moist at all times. In the absence of adequate rainfall, watering shall be applied daily and in sufficient quantities to maintain moist soil to a depth of at least 50 mm. The second and subsequent weeks, water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 100 mm and to maintain sod in a healthy growing condition. Once sod is well rooted, less frequent but deep watering should be performed to encourage deep root growth. The total amount should equal a minimum of 25 mm of water per week. The 25 mm can include rainfall. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

3.4 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of the material used shall be compared with the total area covered to determine the rate of application. The quantity of sod used shall be compared against the total area established with sod. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.5 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.5.1 Technical Representative

The Installation Pest Management Coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.5.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.6 RESTORATION AND CLEAN UP

3.6.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the sodding and topsoiling operations shall be restored to original condition at Contractor's expense.

3.6.2 Clean Up

Excess and waste material shall be removed from the sodded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.7 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the sodding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.8 Turf Maintenance Prior to Plant Establishment

Maintenace of turf shall begin immediately following sodding operations and shall extend to the end of the Sod Establishment Period. Maintenance includes but is not limited to: watering, weeding, mowing, fertilizing, repairing damaged or non-healthy areas, and other operations required to maintain a healthy stand of grass. See specific turf maintenance requirements in Section 02935 Exterior Plant Material Maintenance.

3.9 SOD ESTABLISHMENT PERIOD

3.9.1 Commencement

See 02935 EXTERIOR PLANT MATERIAL MAINTENANCE for detailed sod maintenance requirements. The sod establishment period to obtain a healthy stand of grass plants shall commence on the first day of sodding work under this contract and shall continue through the remaining life of the contract and end 12 months after the last day of sodding operation required by this contract. Written calendar time period shall be furnished for the sod establishment period. The sod establishment period should be coordinated with Sections 02921 SEEDING and 02930 EXTERIOR PLANTING. The sod establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

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SECTION 02930

EXTERIOR PLANTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA Z60.1	(1996) Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2001) Arboricultural Operations - Safety Requirments for Pruning, Repairing, Maintaining, and Removing Trees and Cutting Brush

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a; R 2001) Agricultural Liming Materials
ASTM D 4972	(2001) pH of Soils
ASTM D 5034	(1995; R 2001) Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D 5035	(1995) Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 5268	(1992; R 1997) Topsoil Used for Landscaping Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Geotextile; G
Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for geotextile and chemical treatment material.

Equipment;

A listing of equipment to be used for the planting operation.

Delivery;

Delivery schedule.

Plant Establishment Period; G

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Maintenance Record;G

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

Application of Pesticide;G

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;G

Samples taken from several locations at the source.

Soil Amendments;G

A 4.5 kg sample. Empty bags and other containers for soil amendments shall be saved in designated area for quantity verification at the end of installation.

Organic Mulch;G

A 4.5 kg sample.

Geotextile; G

A 150 mm square sample of each type (permeable and non-permeable).

Rock Mulches; G

A 4.5 kg sample of riverbank rock.

Large Landscape Rock; G

Representative sample of each size requiredprovided from source to be used.

SD-06 Test Reports

Soil Test; G
Soil tests for delivered topsoil at time of delivery and potentially during topsoil and planting installation period.

Percolation Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.Soil test lab shall participate in North American Proficiency Testing Program (NAPT). See Internet site http://css.swu.edu/soil_Testing_Labs.htm for a list of participating Pacific Northwest labs.

SD-07 Certificates

Plant Material;G
Topsoil;G
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Organic Mulch;G
Pesticide;G
Large Landscape Rock;G

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.

b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster: Sieve analysis and calcium carbonate equivalent.

d. Fertilizer: Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Organic Mulch: Composition, source, and treatment against fungi growth.

h. Pesticide. EPA registration number and registered uses.

i. Large Landscape Rock: Composition, sizes available, and source.

SD-10 Operation and Maintenance Data

Maintenance Instructions; G

Instruction for year-round care of installed plant material.

1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Plant Material Identification

No less than twenty (20) percent of each variety and/or species delivered to the project shall be accurately labeled. Whether or not labeled, any plants which no not conform to the Plant Schedule and/or Planting Plan, shall be removed immediately from the jobsite and immediately replaced with conforming plants. Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil as per Specification 02921 Seeding.

1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, damaged or crooked leader, harmful insects or insect damage, or disease and disease damage, disfiguring knots or fresh cut limbs over 19 mm not completely calloused,or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked root balls; or broken containers shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 19 mm diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site immediately.

1.4.3 Storage

1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall be maintained and protected in a safe, healthy, vigorous condition. Plant material shall not be stored longer than 30 calendar days after delivery. After 30 calendar days, plants shall be removed immediately from site and replaced with new plants. Trees stored longer than 10 calendar days shall have twine, rope or other wrapping material removed from branches. Plant material shall be protected from direct exposure to wind and sun. Provide protective screening if necessary. Plant material shall be protected from

drought, unusual weather, temperature extremes, mechanical damage, and vandalism. Temperature extremes such as freezing temperatures are defined as (1.6 degrees C or below at any time day or night). Balled and Burlap plant material shall be completely heeled-in (covered on all sides by a minimum of 150 mm of mulch or topsoil) if temperatures are 1.6 degrees C or below at any time day or night. Plant containers and root balls shall be kept free of weeds, weed seed and weed roots. Plants shall be stored upright; plants that tip over shall be rejected at the discretion of the Contracting Officer. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed. Plants not stored according to these requirements shall be rejected and removed immediately from the job site and replaced at the Contractor's expense.

1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

1.4.4 Handling

Plant material (rootballs, root systems, branches, stems, and leaves) shall not be injured in handling. Plant material shall not be handled by the trunk or stems and shall not be dropped from vehicles. Cracked, broken, gouged, and/or dry-to-the-center rootballs will be rejected. Plant material subject to improper handling shall be rejected. All rejected plant material shall be immediately removed from the jobsite, and replaced at the Contractor's expense.

1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours after planting during June 1 through Septemeber 30 and a maximum of 72 hours for the remainder of the year. Plants not meeting these requirements shall be rejected and removed immediately from the job site and replaced at the Contractor's expense.

1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period from final completion. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract time period. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty after final acceptance. See also 3.9.4 Replacement Plant Material for extended warranty period.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA Z60.1 and shall be the species specified.

2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA Z60.1.

2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant containers, root systems, and root balls shall be free of weeds, weed seed, weed roots, and other unacceptable debris. Plants not meeting quality requirements shall be rejected, removed immediately from site and replaced at Contractor's expense. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

2.1.6 Method of Shipment to Maintain Health of Root System

2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

2.1.6.2 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots

to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.7 Growth of Trunk and Crown

2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.7.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.7.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.7.4 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANLA Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

2.1.7.5 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of

runners and length of runner recommended by ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA Z60.1.

2.2 TOPSOIL

Topsoil shall be delivered and shall be as described in the topsoil requirement specified in SECTION 02921: Seeding, except as noted below. Topsoil for planting beds/areas shall be applied at a minimum compacted depth of 200 mm. Topsoil for planting beds/areas (areas other than turf) shall contain 10-15% by dry weight (as determined by a "loss on ignition" test) of mixed, composted, fine-particle organic matter. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 19 mm diameter. Topsoil shall be free from viable plants and plant parts. Topsoil shall be amended as recommended by the soil test (see following).

2.2.1 Soil Test

A soil test shall be performed for pH, organic matter content, textural class, particle size (sieve analysis), chemical analysis and soluble salts to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite and peat shall not be used. Amendments shall be added as determined by soil test for types of plant materials specified.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.25 mm sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.25 mm sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.25 mm sieve.

2.3.2 Fertilizer

Fertilizer shall be as recommended by the soil test. For bidding purposes, the nutrient ratio shall be 20 percent nitrogen, 10 percent phosphorus, and 5 percent potassium. Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.3.3 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.3.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen. Decomposed wood derivatives shall have a carbon to nitrogen ratio below 25:1.

2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source.Compost shall be supplied from a permitted compost facility in Washington State. Compost shall be in compliance with Washington State

Department of Ecology Interim Guidelines for Compost Quality, Grade A/WAC Chapter 173-350 Section 220. Compost shall have a carbon to nitrogen ratio below 25:1. If the plantings are composed entirely of plants native to the Puget Sound Lowlands region, the carbon to nitrogen ratio shall be below 35:1. Compost shall have an organic matter content of 35% to 65% as determined by "loss of ignition" test method. It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 7.5, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length.

2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source and shall be commercially packaged.

2.3.4 Soil Conditioner

Soil conditioner shall be sand, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.4.2 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure shall not be used as a mulch because it would encourage surface rooting of the plant material and weeds.

2.4.1 Inorganic Mulch

Inorganic mulch (rock mulch) used for decorative purposes shall be provided in areas designated. It shall consist of washed riverbank stone 19 mm to 75 mm in size with one-third (33.3%) of mix 19 mm - 25 mm in size, one-third 26 mm - 50 mm, and one-third 51-75 mm in size.

2.4.2 Organic Mulch

Organic mulch materials shall be medium grind shredded fir or hemlock bark manufactured specifically for landscape use.

2.4.2.1 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.5 LARGE LANDSCAPE ROCKS

Large landscape rock shall be locally available (within 4 hours drive), naturally-occurring shaped landscape rock. Rocks shall have earth tone colors consisting of grays. Large landscape rock shall be rounded, sound (solid) granite. Rock sizes shall be as follows: 40% of rocks shall be 2-man rocks (712 mm to 914 mm, 317 kg to 454 kg) and 60% of rocks shall be 3-man rocks (914 mm to 1.2 m, 454 kg to 907 kg). Layout shall be approved by the Contracting Officer.

2.5 GEOTEXTILE (Weed Barrier Fabric)

Weed barrier fabric shall be used under rock mulch. It shall be a non-woven polyester/polyethylene film laminate, spun bonded, water permeable non-brittle mat in accordance with ASTM D 5034 or ASTM D 5035. It shall weigh a minimum of 136 grams per square meter, and be a minimum of .25 mm thick. Permeability rate shall be a minimum 1 mm per second. Weed barrier fabric shall be Weed-X by Dalen or equal. Fabric anchors shall be 25 mm by 15 mm, U-Shaped, 3.0 mm staples. Weed barrier fabric shall be made specifically as a commercial grade, landscape fabric for use around plant material.

2.6 STAKING AND GUYING

All trees (double-stake) and evergreens (single-stake at angle) shall be staked. Tree staking will be removed by the contractor at the end of the 12-month maintenance plant establishment period. Staking materials shall consist of:

2.6.1 Bracing Stake

Two stakes shall be used for deciduous and broadleaf evergreen trees and one stake for coniferous evergreen trees. Wood bracing stakes shall be a minimum 50 x 50 mm square and 2400 mm long with a point at one end. Wood stakes shall be hardwood or fir; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

2.6.2 Tie Material

The tie material shall be a soft, wide, non-abrasive surface to minimize trunk abrasion and possible girdling, and allow modest movement of the stem of the tree. Tie materials include wide cloth belting, elastic webbing, wide rubber belts, and a flat woven polypropylene material 19 mm wide, 900 lb. break strength, color white ('ArborTie' from Deep Root or approved equal). Materials which may abrade and cut into the stem of tree such as wire, string, and fishing line shall not be used. Attach tie material to

stakes to prevent them from sliding down stake.

2.7 EDGING

2.7.1 Concrete Edging

Concrete mow edging shall be 150 mm wide by 300 mm deep. Edging shall have expansion joints of 13 mm premolded filler at 6M O.C. and a 6 mm radius on top edges. Expansion joints shall be provided where concrete mow edge abuts other concrete structures.

2.7.2 Hand-Tooled Edging

For hand-tooled edging see Detail 8, PL. L-502. Hand-tooled edging shall be used at outside edge of mulch ring for trees located in turf areas.

2.8 WATER

Water will be furnished by the Government.

2.9 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

PART 3 EXECUTION

3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

3.1.1 Plant Material Time

Planting shall occur between 01 September and 31 May.

3.1.2 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. Summer planting shall be avoided. Planting shall not occur when drought, excessive moisture, excessive heat ambient temperature above 26 degrees C (80 degrees F), cold ambient temperatures below 1.6 degrees C (35 degrees F), frozen ground, high winds (30 mph or greater) or other unsatisfactory, or extreme conditions prevail. Planting shall not occur when local day and nighttime ambient temperatures are forecast to be below 1.6 degrees C (35 degrees F) within the 48 hour period following planting. See 1.4.3.1 for plant storage requirements during unsatisfactory planting periods. During these conditions notify the Contracting Officer and the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to the Contracting Officer for approval. Even if approved, if the Contractor conducts planting operations outside the planting periods listed above or under unseasonable conditions, they do so without additional compensation and by accepting FULL responsibility for any subsequent, resulting losses.

3.1.3 Tests

3.1.3.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 25 mm per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures. One percolation test shall be conducted for each building site and one each in each of the two Troop Training Areas.

3.1.3.2 Soil Test

Delivered topsoil and excavated plant pit soil shall be tested in accordance with ASTM D 5268 and ASTM D 4972. See Section 02921 Seeding, paragraph 3.1.4 Soil Test for test requirements.

3.2 SITE PREPARATION

3.2.1 Subgrade, Topsoil, Finished Grade and Underground Utilities

The Contractor shall verify that subgrades are as indicated on drawings, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation.

Remove all grass/sod, weeds and other unacceptable vegetation, debris and rocks over 19 mm and provide a smooth, even surface to achieve finish grade. Topsoil shall be spread at a minimum compacted depth of 200 mm in planting beds/areas, except for areas in plant beds that are within the dripline of existing trees. 50 mm depth of topsoil shall be installed in plant bed areas within the dripline of existing trees. Do not spread topsoil or soil amendment when frozen or excessively wet or dry. Protect topsoiled areas from damage by vehicular or pedestrian traffic.

The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

3.2.3 Protecting Existing Vegetation

Existing trees to be preserved shall be barricaded with orange construction fencing at the dripline of each tree.

3.2.3.1 Installing Large Landscape Rocks

Large landscape rock shall be installed where indicated on the drawings.

Placement shall be to mimic locally found, naturally-occurring outcroppings. Rocks shall be buried at least 1/3 of the total height. Rocks placed within 10M of building perimeters shall be between 100 mm and 150mm in height above finish grade after installation. Spacing for the rocks shall be as indicated on the plans and to prevent a vehicle from driving between the boulders. Also see sheet L-502, detail 10. Final rock placement shall be approved by the Contracting Officer.

3.2.3.2 Preparing Existing Trees and Areas Surrounding Existing Trees

Existing trees to be preserved shall be crown-pruned to remove all dead, broken, or hazardous branches. Trees located along roads that have overhanging branches shall be pruned to provide vehicle clearance fifteen (15) feet above the ground. Pruning shall be accomplished by a certified arborist (International Society of Arborists-ISA certified)in accordance with ANSI A300 and ANSI Z133.1. Trees to remain shall also have all flagging, paint, hardware, or other man-made products removed prior to new exterior plant material installation. If the certified arborist determines that a tree is hazardous using an ISA acceptable Hazardous Tree Evaluation and removal is recommended, the COR shall be notified and approval granted prior to a tree's removal. The tree shall be removed at the Government's expense at the same unit cost established for trees being removed during demolition.

The surface area lying within the dripline of trees shall be cleared of weeds, grass, and other existing unacceptable vegetation and debris by hand only. After the removal of existing sod/grass, weeds and other unacceptable vegetation and debris, mulch shall be applied to the following area: 1) in an area equal to a 6.1-meter diameter circle around the tree trunk, or 2)if the tree's dripline is less than 6.1 meters, the mulch area shall equal the dripline of the tree. The dripline is defined as the circle drawn on the soil around a tree directly under its outermost branch tips. The mulch layer shall be 75 mm deep. Minimal topsoil shall be applied within the dripline to establish a uniform grade.

3.2.4 Pre-Emergent

A pre-emergent herbicide shall be applied to all planting beds after planting is 100% and prior to mulch installation. Pre-emergents shall **not** be used within the dripline of trees to remain.

3.3 EXCAVATION

3.3.1 Obstructions

When obstructions below or above ground (utilities etc.)affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

3.3.2 Plant Pits

Plant pits for ball and burlapped and container plant material shall be dug according to tree, shrub and ground cover planting details.

3.4 INSTALLATION

3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown, or slightly above the grade at which it was grown(0 to 13mm).

3.4.2 Backfill Soil Mixture

3.4.2.1 Backfill Soil Mixture

The backfill soil mixture shall be a proportioned mixture thoroughly mixed as follows: Existing excavated soil = 1 part to mixture; Imported topsoil = 2 parts to mixture. Topsoil shall be as specified in Specification SECTION 02921: SEEDING. Backfill soil mixture shall be amended as per soil test for delivered and existing excavated pit topsoil. The Contractor shall remove all spoils from the jobsite immediately.

3.4.3 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

3.4.3.1 Balled and Burlapped Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/2 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped. After plant is set, cut and remove the top 1 /2 of the burlap material and remove all twine. For plants with wire baskets, cut away and remove the top 1/3 of the wire basket. Dispose of wire basket and other debris generated from the planting operations offsite, immediately.

3.4.3.2 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped.

3.4.3.3 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 100 mm height along the downside edge of shrub and tree plant pits where located in areas where the slope is 20% or greater to aid in water retention and to provide soil for settling adjustments.

3.4.4 Plant Bed

Plant material shall be installed/planted in plant beds according to the detail drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. All trees shall be installed prior to spreading of imported topsoil to eliminate rock from the finished grade.

3.4.5 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

3.4.5.1 Edging

All edges of tree mulch circles shall be uniformly shaped and edged (hand-tooled edge) using a sharp tool to provide a clear-cut division line between the planted area and adjacent lawn. See Detail 3, Pl. L-501.

Plant beds and river rock areas adjacent to turf areas shall be edged with a concrete mow edge typical as indicated on the plans. The concrete mow edges shall be installed as detailed on Pl. L-502. Finish grade of the mow edge shall be installed 13 mm above finish grade of the grass areas to facilitate mowing. The concrete mow edge shall give a smooth, even, uniform, consistent appearance free from noticeable elevation changes. Changes in radius shall be gentle and flow smoothly.

3.4.6 Staking and Guying

Tree staking shall be removed at the end of the 12-month maintenance plant establishment period.

3.4.6.1 One Bracing Stake

Coniferous trees shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven at a 45 degree angle into firm ground and shall not injure the ball or root system.

3.4.6.2 Two Bracing Stakes

As approved by Contracting Officer, trees shall be anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground outside the rootball so that there is no injury to the ball or root system. Stakes shall be positioned in-line with the prevailing wind direction so the tree trunk can move with the prevailing winds.

3.5 FINISHING

3.5.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

3.5.2 Placing Geotextile (Weed Barrier Fabric)

Prior to placing rock mulch geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

3.5.3 Placing Mulch

The placement of mulch shall occur a maximum of 24 hours after planting during June 1 through Septemeber 30 and a maximum of 72 hours for the remainder of the year. Organic mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 75 mm uniform thickness for trees, shrubs, and groundcovers.

Individual trees or shrubs in seeded areas or rock mulch, shall have a mulched bed, circular in shape. Rings shall be 1.0 m diameter for trees and .5 m diameter for shrubs.

Rock mulch shall be placed to a minimum thickness of 150 mm. Mulch shall not be placed within 100 mm of the trunks of trees.

3.5.4 Pruning

Pruning new plant material shall be accomplished by trained and experienced personnel. The pruning of trees shall be in accordance with ANSI A300. Only dead, diseased, or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off". Pruning the lower 1 or 2 limbs on trees to create a uniform branching height shall be approved by COR. This type of pruning shall not adversely affect the overall shape and form of the tree.

3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, straightening plants and adjusting plant material for settlement. See detailed maintenance requirements in 3.9.2 Maintenance Required PRIOR to Commencement of the Plant Establishment Period .

3.7 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.7.1 Technical Representative

The certified Installation Pest Management Coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.7.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.8 RESTORATION AND CLEAN UP

3.8.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.8.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared. Clean-up shall take place on a daily basis.

3.9 PLANT ESTABLISHMENT PERIOD

3.9.1 Commencement

Maintenance of the exterior plant materials is required during a 12-month Plant Establishment Period and shall be provided by the Contractor in accordance with Specification 02935 Exterior Plant Material Maintenance.

3.9.2 Maintenance Required PRIOR to Commencement of the Plant Establishment Period

The purpose of the maintenance requirements herein are to be in effect from the time plants are installed until the beginning of the Plant Establishment Period. Maintenance of plant material shall include straightening plant material; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips;

maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; adjusting plant material for settlement, and removing and replacing unhealthy plants.

3.9.2.1 Watering Plant Material

The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 25 mm absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

3.9.2.2 Weeding

Grass and weeds in the installed areas **SHALL NOT** be allowed to reach a maximum 75 mm height before being completely removed, including the root system.

3.9.2.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.2.4 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 1 kilogram per 10 square meters of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.9.2.5 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

3.9.2.6 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

3.9.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. Trees unable to remain upright (without staking) shall be removed immediately and replaced

as soon as seasonal conditions permit. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement (substitutions shall be approved by COR). Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.9.4 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with paragraph 2.1 PLANT MATERIAL. Replacement plant material shall be installed in accordance with paragraph 3.4 INSTALLATION, and recommendations in Part 3.9 PLANT ESTABLISHMENT PERIOD. Any plant material which requires replacement, shall be replaced within one-week after contition noted. This includes before or after Final Acceptance. Plants replaced prior to Final Acceptance that again die or are considered unhealthy plant material, shall be replaced again within one-week. This requirement shall be in place until Final Acceptance. After Final Acceptance plant material shall be replaced in accordance with paragraph 1.5 WARRANTY and following.

The guarantee of all replacement plants shall extend for an additional period of one year from the date of their acceptance after replacement. The Contractor shall make periodic inspections, at no extra cost, during the guarantee period to determine what changes, if any, should be made in the maintenance program. If changes are recommended, they shall be submitted in writing to the Contracting Officer. Claims by the Contractor that the owner's maintenance practices or lack of maintenance resulted in dead or dying plants will not be considered if such claims have not been documented by the Contractor during the guarantee period.

3.10 FINAL ACCEPTANCE

3.10.1 Preliminary Inspection

Prior to the end of the plant establishment period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection will be established in writing. The quantity and type of plants installed and the acceptability of the plants shall bein accordance with paragraph 3.9 Maintenance Required Prior to Commencement of the Plant Establishment Period, shall be determined. Plants shall be in a healthy, vigorous condition.

3.10.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

-- End of Section --

SECTION 02935

EXTERIOR PLANT MATERIAL MAINTENANCE

PART 1 GENERAL

This specification applies to the one-year plant establishment (maintenance) period for all plant material, irrigation operation, and all landscape materials installed under Specification Sections 02811, 02921, and 02930. The one-year plant establishment period shall begin following final acceptance by the Contracting Officer of the installed seeding, sodding, exterior plant materials, and irrigation system(s)of the entire project. Maintenance prior to final acceptance shall be the responsibility of the landscape Contractor.

Written calendar time period shall be furnished for the commencement of the plant establishment period. Use of more than one plant establishment period may be used with approval from the Contracting Officer: the boundaries of the planted area/zone covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02921 SEEDING, 02811 UNDERGROUND SPRINKLER SYSTEM; and 02930 EXTERIOR PLANT MATERIAL. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4972	(2001) pH of Soils

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for chemical treatment material.

Application of Pesticide; G

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-06 Test Reports

Soil Tests; G

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Plant Material; G
Topsoil; G
pH Adjuster;
Fertilizer;
Organic Material;
Mulch; G
Pesticide; G

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.

b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material. Composition and source.

f. Mulch: Composition and source.

g. Pesticide. EPA registration number and registered uses.

SD-10 Operation and Maintenance Data

Plant Establishment Period; G

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Work Plan and Schedule; G
Delivery Schedule; G

Contractor's work plan including Maintenance Instructions, Task Charts (see 3.6 General Maintenance Requirements) and schedules.

Maintenance Record; G

Contractor's record of each site visit.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery Schedule

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.3.2 Delivery of Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.3.3 Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.3.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

PART 2 PRODUCTS

See Sections 02921, 02922 and 02930 for products required for maintenance.

PART 3 EXECUTION

3.1 SOIL TESTS

Contractor shall perform soil tests in accordance with ASTM D 4972when lawn or plant establishment is below acceptable standards or as directed by the Contracting Officer.

3.2 SITE PREPARATION

3.2.1 Applying pH Adjuster

The pH adjuster shall be applied at a rate as recommended based on soil test or by manufacturer.

3.2.2 Applying Fertilizer

Apply fertilizer at rate as recommended based on soil test or by manufacturer.

3.3 MULCHING

Mulch shall be applied to a minimum depth of 50 mm when less than 25 mm of mulch exists.

3.4 WATERING

Water to supplement rainfall shall be applied at a rate sufficient to ensure plant growth a minimum of 25 mm per week for tree, shrub, and groundcover areas and a minimum of 25-38 mm per week for turf. Contractor shall adjust each zone to customize irrigation water amount specific to that zone. Contractor shall also modify programming to allow for seasonal requirements. This customizing shall occur once in each of the three watering seasons. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.5 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.5.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control.

3.5.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal

protective equipment shall be used as specified on the pesticide label. A closed system is recommended to prevent the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.6 GENERAL MAINTENANCE REQUIREMENTS

Maintenance requirements shall predominantly follow the maintenance instructions provided in Section 02930 Exterior Planting, Maintenance Required Prior to Commencement of the Plant Establishment Period.

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement. Plant photographs of representative specimens of each type of tree, shrub, and groundcover in the plant list and approved substitutions used on the project shall be included. Plant photographs shall be color and 75 mm x 125 mm taken from an angle that depicts the size and condition of the typical plant furnished in the project. A scale rod or other measuring device shall be included in the photograph. Label each photograph with the plant name, plant size, and name of the growing nursery.

A Task Chart or matrix indicating activities or tasks as required per this specification that should be occurring each month shall be developed and submitted to the Contracting Officer for approval.

3.6.1 Fertilization

Fertilizer shall be applied at rate recommended by the manufacturer and/or according soil tests. Application shall be timed prior to the advent of winter dormancy and performed without burning plants.

3.6.2 Pesticide Treatment

Pesticide treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.6.3 Irrigation Maintenance

The Contractor shall service and repair controller, pumps, valves,quick couplers, sprinkler heads, piping; and shall be responsible for winterization and startup. Sprinkler heads shall direct water away from building. The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone; the amount of water required shall be the equivalent of 25 mm absorbed water per week for trees, shrubs, and groundcover areas and the equivalent of 25-38mm absorbed water per week for turf areas. Amount of irrigation watering shall take amounts of rain into account. See also Section 02811 Underground Sprinkler System and 3.4 Watering this section.

The contractor shall develop and submit a Task Chart or matrix depicting operation and maintenance activities recommended for the installed irrigation system(s) for each month of the year.

3.6.4 Maintenance Record

A record of each site visit shall be furnished, describing:

a. Maintenance work performed.

b. Areas repaired or reinstalled.

c. Diagnosis for unsatisfactory stand of grass.

d. Diagnosis for unsatisfactory stand of plant material in planting bed.

e. Condition of trees.

f. Condition of shrubs and ground covers.

g. Quantity and diagnosis of plant loss.

h. Irrigation of system.

3.7 GRASS PLANT QUALITY

Grass plants shall be evaluated for species and health when the grass plants are a minimum 25 mm high. The living grass area shall be maintained to be uniform in color and leaf texture; and free from weeds and other undesirable growth. The living grass area shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 13 mm in diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the total area.

3.7.1 Satisfactory Stand of Sod Grass Plants

Grass plants shall be evaluated for species and health. A satisfactory stand of grass plants from the sodding operation shall be living sod uniform in color and leaf texture. Sodded areas shall show vigorous growth and bare spots shall be a maximum 50 mm square. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

3.7.2 Satisfactory Stand of Seeded Turf Areas

Seeded Areas: A satisfactory stand of grass plants shall be as follows: Seeded areas shall show vigorous growth and bare spots shall be a maximum 100 mm square. The total bare spots shall be a maximum 2 percent of the total area.

3.8 LAWN AND FIELD AREAS MAINTENANCE

3.8.1 Mowing

Lawn and field areas shall be mowed throughout the growing season to meet the requirements of paragraph GRASS PLANT QUALITY. Cutting height shall be adjusted according to type of grass. Frequency of mowing shall be adjusted so that no more than 1/3 of leaf length is removed during a cutting.

3.8.1.1 Turf Areas

Fine Lawn areas shall be mowed throughout the growing season. Perimeter/disturbed areas shall be mowed to a minimum of heigth of 100 mm when the turf reaches a maximum height of 225 mm. Remove clippings from the fine lawn areas only.

3.8.2 Turf Trimming

Turf adjoining paved areas, planting beds and trees shall be kept neatly trimmed at all times, essentially after each mowing. String trimmers are prohibited: tree rings and concrete edging will eliminate their need.

3.8.3 Aeration

Fine Lawn Areas areas shall be aerated once per year using approved devices. Coring shall be performed by pulling soil plugs to a minimum of 100 mm. Cores and miscellaneous debris generated during aeration operations shall be removed within 48 hours of aeration operations.

3.8.4 Lime

Lime for pH modification shall be applied as required to meet the requirements of paragraph.

3.8.5 Herbicide Weed Control

One or more applications of a pre-emergent herbicide and of a post-emergent herbicide shall be applied as needed to meet the requirements of paragraph GRASS PLANT QUALITY.

3.8.6 Turf Fertilization Program

A regular program of fertilization shall be established to include a spring feeding and early summer feeding to meet the requirements of paragraph GRASS PLANT QUALITY. A total of 1.8 kg of Nitrogen per 10 square meters shall be applied annually. Additional 0.5 kg of Nitrogen per 10 square meters shall be provided as grass color warrants. Fine Lawn areas shall be fertilized once per year. Erosion Control areas require no fertilization.

3.9 PLANTING BEDS MAINTENANCE

3.9.1 Trimming

Spent flower heads shall be removed. Seasonal succession of bloom requires removal for new plant or trimming back bulb foliage.

3.9.2 Irrigation of Planting Beds

Run-off, puddling and wilting, watering of other adjacent areas or existing plant material shall be prevented.

3.9.3 Weed Control

Grass and weeds in the installed areas **SHALL NOT** be allowed to reach a maximum 75 mm height before being completely removed, including the root system.

3.10 PLANT MATERIAL QUALITY

3.10.1 General Requirements

Plant material shall be identified as native to the region of the site or as a specimen. Plant material shall be maintained as well shaped, well grown, vigorous plant material having healthy root systems. The plant material shall be maintained as free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems. Plant quality is determined by the growing conditions; climate and microclimate of the site for maintaining a healthy root system; and growth of the trunk and crown as follows.

3.10.2 Growth of Trunk and Crown

3.10.2.1 Deciduous Trees

Deciduous tree height to caliper relationship shall be maintained. Height of branching shall bear a relationship to the size and species of the tree and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: To be considered a stem, there shall be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: The tree shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be indicated.

3.10.2.2 Deciduous Shrubs

Deciduous shrub height to number of primary stems shall be maintained. Shrubs shall be maintained as well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the site.

3.10.2.3 Coniferous Evergreen Plant Material

Coniferous evergreen plant material height-to-spread ratio shall be maintained. The coniferous evergreen trees shall not be "poled" or the leader removed. The plant material shall be maintained to be well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be indicated.

3.10.2.4 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material height-to-spread ratio shall be maintained. The plant material shall be shaped to be recognized by the trade as typical for the variety grown in the region of the site.

3.10.2.5 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall be maintained to have a heavy, well developed, and balanced crown with vigorous, well developed root system.

3.11 SHRUB AND HEDGE MAINTENANCE

3.11.1 Trimming and Pruning

Trimming shall be performed to ensure the following:

a. Safety.

b. Quality (size, height, and shape).

c. Health (removing broken, diseased branches).

d. Rejuvenation (removing one third to one half of the older stems or branches).

e. Visibility (signs, building entrances, motorist line of sight).

Shrubs shall be pruned to the requirements of paragraph 3.10 PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300 and ANSI Z133.1. The typical growth habit of individual plant material or the theme shape of the hedge shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed.

3.11.2 Irrigation of Shrubs and Hedges

Run-off, puddling and wilting shall be prevented.

3.11.3 Shrub Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph 3.10 PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.12 TREE MAINTENANCE

3.12.1 Trimming and Pruning of Trees

Trimming shall be performed to ensure the following:

a. Safety.

b. Quality (size, height).

c. Health (removing broken, diseased wood branches).

d. Rejuvenation (removing one third to one half of the older stems or branches).

e. Visibility (signs, building entrances, motorist line of sight).

Trees shall be pruned to meet the requirements of paragraph 3.10 PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300 and ANSI Z133.1. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.12.2 Irrigation of Trees

Run-off, puddling and wilting shall be prevented.

3.12.3 Tree Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.12.4 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement (substitutions shall be approved by COR). Unhealthy or dead plant material shall be removed immediately and replanted as soon as seasonal conditions permit.

3.12.5 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with Section 02930 paragraph 2.1 PLANT MATERIAL. Replacement plant material shall be installed in accordance with Section 02930

paragraph 3.4 INSTALLATION. Plant material shall be replaced in accordance with Section 02930 paragraph 1.5 WARRANTY. The guarantee of all replacement plants shall extend for an additional period of one year from the date of their acceptance after replacement. The Contractor shall make periodic inspections, at no extra cost, during the guarantee period to determine what changes, if any, should be made in the maintenance program. If changes are recommended, they shall be submitted in writing to the Contracting Officer. Claims by the Contractor that the owner's maintenance practices or lack of maintenance resulted in dead or dying plants will not be considered if such claims have not been documented by the Contractor during the guarantee period.

3.12.6 Removal of Flagging, Staking/guying, and Plant labeling Materials

All materials applied to any plants for the purposes of flagging, staking and guying or labeling shall be removed by the Contractor prior to the completion of the one-year plant establishment period. Trees that do not remain upright after stake removal, shall be rejected, removed from the jobsite immediately, and replaced in-kind.

3.13 RESTORATION AND CLEAN UP

3.13.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the maintenance operations shall be restored to original condition at Contractor's expense.

3.13.2 Clean Up

Excess waste material and general litter shall be removed from the maintenance areas and disposed of off site at the end of each day. Adjacent paved areas shall be cleaned as determined by the Contracting Officer.

3.14 CLEANING OF PAVED AREAS

Grass, weeds, leaves, and debris from mowing, clipping, and pruning shall be removed immediately after cleaning operations. Excess waste material and general litter shall be removed from paved areas and disposed off site. Debris, leaves and litter shall be cleaned from paved areas monthly.

3.15 FINAL ACCEPTANCE

3.15.1 Preliminary Inspection

Prior to the end of the plant establishment period a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The quantity and type of replacement plants installed and the acceptability of all plants maintained in accordance with the plant establishment period shall be determined. Plants shall be in a healthy, vigorous condition.

3.15.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the plant establishment period is subject to the guarantee of plant growth. Final acceptance of the exterior plant establishment period shall be at the end of the one-year plant establishment period and requirements specified herein and in accordance with Section 02921 Seeding; 02930 Exterior Planting; and 02811 Underground Sprinkler System.

-- End of Section --

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FOREST STEWARDSHIP COUNCIL (FSC)

FSC CWP (2002) Listing of Certified Wood Products

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Formwork

Drawings showing details of formwork, including dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form and shoring removal.

SD-03 Product Data

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

Form Releasing Agents ; G

Manufacturer's recommendation on method and rate of application of form releasing agents.

SD-07 Certificates

For all wood products incorporated as "certified wood" provide evidence of compliance with FSC CWP standards for certified wood. Evidence shall consist of suppliers invoices with certified products indicated on a line item basis.

SD-12 LEED Documentation

Manufacturing Plant Location; G,
Regional Material Extraction; G,

Manufacturer's statement location of the manufacturing plant where material was produced and percentage of the products' raw materials extracted regionally in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for concrete materials. Contractor is also encouraged to recycle clean and otherwise suitable wood obtained from demolition activity in concrete formwork.

1.4 Certified Wood

A minimum of 50 percent of all lumber and panel products provided under this specification shall be certified wood meeting FSC CWP standards and certification. Provide required documentation per LEED-NC RG.

1.5 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Metal Form Deck

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section 05300 STEEL DECKING.

2.1.5 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 6 mm nor more than 25 mm deep and not more than 25 mm in diameter. Removable tie rods shall be not more than 38 mm in diameter.

2.1.6 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.1.7 Certified Wood

A minimum of 50 percent of all lumber and panel products provided under this specification shall be certified wood meeting Forest Stewardship Council standards and certification.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive

units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

3.5 FOUNDATIONS

Concrete for footings may be placed in excavations without forms, upon inspection and approval by the Contracting Officer. Excavation width shall be a minimum of 3" greater than indicated. Stem walls, grade beams and retaining wall sides shall be formed.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1.	Variations from the plumb:	In any 3 m of length -------- 6 mm
	a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length -- 25 mm
	b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 6 m of length -------- 6 mm Maximum for entire length 13 mm
2.	Variation from the level or from the grades indicated on the drawings:	In any 3 m of length ------- 6 mm In any bay or in any 6 m of length ---------- 10 mm
	a. In slab soffits, ceilings beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length - 20 mm
	b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 6 m of length ---------- 6 mm Maximum for entire length - 13 mm
3.	Variation of the linear building lines from established position in plan	In any 6 m ---------- 13 mm Maximum ---------- 25 mm
4.	Variation of distance between walls, columns, partitions	6 mm per 3 m of distance, but not more than 13 mm in any one bay, and not more than 25 mm total variation
5.	Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ---------- 6 mm Plus ---------- 13 mm
6.	Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ---------- 6 mm Plus ---------- 13 mm

7. Footings:

a. Variation of dimensions in plan	Minus ---------- 13 mm Plus ---------- 50 mm when formed or plus 75 mm when placed against unformed excavation
b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than --------- 50 mm
c. Reduction in thickness	Minus ---------- 5 percent of specified thickness

8. Variation in steps:	Riser ---------- 3 mm
a. In a flight of stairs	Tread ---------- 6 mm
b. In consecutive steps	Riser ---------- 2 mm Tread ---------- 3 mm

-- End of Section --

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 152	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 152M	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar (Metric)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 471	(1998e1) Rubber Property - Effect of Liquids
ASTM D 1190	(1997) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1191	(1984; R 1994el) Concrete Joint Sealers
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications

for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops ; G, RE

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Preformed Expansion Joint Filler
Sealant
Waterstops

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-04 Samples

Lubricant for Preformed Compression Seals

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 3 m of 25 mm nominal width or wider seal or a piece not less than 4 m of compression seal less than 25 mm nominal width. One L of lubricant shall be provided.

Field-Molded Type

Four liters of field-molded sealant and one L of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

Non-metallic Materials

Specimens identified to indicate manufacturer, type of material,

size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 300 mm long cut from each 61 m of finished waterstop furnished, but not less than a total of 1 m of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 300 mm long.

SD-07 Certificates

Preformed Expansion Joint Filler ;G, RE
Sealant ;G, RE
Waterstops ;G, RE

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 3 mm thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

2.3.1 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

2.3.2 Field-Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints,

Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B 152M (ASTM B 152) and ASTM B 370, O60 soft anneal temper and 0.686 mm (20 oz mass per sq. ft)sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480/A 480M, Type 304L), and 0.9525 mm thick strip.

2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109/A 109M, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570/A/A 570M, Grade 40.

2.4.3 Non-Metallic Materials

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.4.4 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 2.9 MPa (420 psi) minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 20 degrees C (70 degrees F) shall be 3 to 1 minimum.

2.4.5 Preformed Elastic Adhesive

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

2.4.5.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below:

PERCENT BY WEIGHT

COMPONENT	MIN.	MAX.	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D 4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D 6

2.4.5.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 2 m head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 65 kPa which is reached by slowly applying increments of 13 kPa every minute.

2.4.5.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 25 mm wide and 150 mm long flush with sealing compound and place in an oven at 58 degrees C in a vertical position for 5 days.

2.4.5.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by cutting the concrete with a saw after concrete has set. Joints shall be approximately 3 mm wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 25 mm.

3.1.1.1 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical

surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 3 mm radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 4 degrees C. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Carbon flame shall not be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 25 mm onto undamaged portion of the waterstop.

3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.3.3 Quality Assurance

Edge welding will not be permitted. Center bulbs shall be compressed or closed when welding to non-center bulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of center bulb, ribs, and end bulbs greater than 2 mm. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 2 mm or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 13 mm in 3 m. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9)

Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacryiate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 25 mm overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 318M	(1995) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(2002) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 497	(1997) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	(2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	(1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1997) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement
ASTM A 775/A 775M	(1997e1) Epoxy-Coated Reinforcement Steel Bars
ASTM C 1116	(2003) Fiber-Reinforced Concrete and Shotcrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code - Reinforcing Steel

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement ; GA

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing. Drawings shall conform to detailing and placing drawing recommendations of CRSI MSP-1.

SD-03 Product Data

Welding ; GA

A list of qualified welders names.

SD-07 Certificates

Reinforcing Steel ; GA

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing

plant where steel was produced, and percentage of the steel's raw materials extracted regionally in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for steel concrete reinforcement products.

1.4 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.5 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 SMOOTH DOWELS

Dowels shall conform to ASTM A 675/A 675MM, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185 or ASTM A 497. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884MM.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.7 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 50 mm.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete without prior approval of the Contracting Officer. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms. "Tack" welding to or of reinforcement is prohibited welding of reinforcing bars shall be done with low hydrogen electrodes in accordance with AWS D1.4.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318M at locations shown within tolerances of ACI 117/117R. Reinforcement shall not be continuous through expansion isolation joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 36M unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds.

Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1220 mm. Fabric shall be positioned by the use of supports.

3.3 SMOOTH DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C 1116 and the recommendations of the manufacturer, and in an amount of 0.1 percent by volume.

3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

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SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 RELATED SECTIONS

03200 CONCRETE REINFORCEMENT
03330 CAST-IN PLACE ARCHITECTURAL CONCRETE
03312 COLORED POLISHED CONCRETE FLOOR
15750 RADIANT FLOOR HEATING AND COOLING SYSTEM

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 302.1	(1996) Guide For Concrete Floor And Slab Construction
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 2000) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical

	Concrete Specimens
ASTM C 42	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1999) Ready-Mixed Concrete
ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(2002ae1) Portland Cement
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 192/C 192M	(1998) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(2003) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 309	(2003 Rev. A) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	(1999) Chemical Admixtures for Concrete
ASTM C 552	(2000e1) Cellular Glass Thermal Insulation
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 618	(1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1997) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 1017	(1998) Chemical Admixtures for Use in Producing Flowing Concrete

ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1107	(2002) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	(2003) Fiber-Reinforced Concrete and Shotcrete
ASTM D 75	(2003) Sampling Aggregates
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

CORPS OF ENGINEERS (COE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

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1.3 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mixture Proportions; G

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-06 Test Reports

Testing and Inspection for Contractor Quality Control; G

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. No cement, pozzolan or slag shall

be used until notice of acceptance has been given.

SD-07 Certificates

Qualifications; G

Written documentation for Contractor Quality Control personnel.

SD-12 LEED Documentation

Recycled Content; G,
Resource Reuse; G,
Manufacturing Plant Location; G,
Regional Material Extraction; G,

Manufacturer's statement of material's post-consumer and post-industrial recycled content, percentage of aggregate reused from demolished structures on project site, location of the manufacturing plant where concrete was produced, and percentage of the product's raw materials extracted regionally in accordance with LEED-NC RG.

1.5 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for concrete materials.

1.6 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I

Concrete Laboratory Testing Technician, Grade I or II

Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or Reinforced Concrete Special Inspector, Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.7 GENERAL REQUIREMENTS

1.7.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.7.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.7.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 3 m straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. Finished surfaces shall be plane, with no deviation greater than 6 when tested with a 3m straightedge. Flatness and Levelness for colored polished concrete floors is specified in SECTION 03312.

1.7.2 Strength Requirements and w/c Ratio

1.7.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
27.5 MPa (4000 psi) at 28 days	all

Concrete slabs on-grade shall have a minimum 28-day flexural strength of 4.5 MPa. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39. Flexural strength shall be determined in accordance with ASTM C 78.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and

tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 3.5 MPa. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 MPa or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

d. Evaluation of Concrete Flexural Strength. Flexural strength specimens (beams) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 78. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength and no individual test result falls below the specified flexural strength by more than 350 kPa. A "test" is defined as the average of two companion beams. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the

strength of the concrete in the slab is considered potentially deficient.

1.7.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c), by weight, for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.4	slabs and walls
0.45	footings
0.45	other

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.7.3 Air Entrainment

All concrete which shall be permanently exposed to weather shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 19 mm or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 35 MPa may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

For colored polished concrete floor, SECTION 03312, the concrete shall not be air entrained.

1.7.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump Minimum	Slump Maximum
Walls, columns and beams	50 mm	100 mm
Foundation walls, substructure walls, footings, slabs	25 mm	100 mm
Any structural concrete approved for placement by pumping:		
At pump	50 mm	150 mm
At discharge of line	25 mm	100 mm

When use of a plasticizing admixture conforming to ASTM C 1017 or when a

Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 50 to 100 mm before the admixture is added and a maximum slump of 200 mm at the point of delivery after the admixture is added.

1.7.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C. When the ambient temperature during placing is 5 degrees C or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C.

1.7.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.7.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.8 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.8.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on water / cement ratio and compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus

pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.8.2 Proportioning Studies for Flexural Strength Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except that proportions shall be based on flexural strength as determined by test specimens (beams) fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 78. Procedures given in ACI 211.1 shall be modified as necessary to accommodate flexural strength.

1.8.3 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.8.3.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation

shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 7 MPa of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in MPa
f'cr = f'c + 2.33S - 3.45 where units are in MPa
Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.8.3.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 20 MPa,

f'cr = f'c + 6.9 MPa

b. If the specified compressive strength f'c is 20 to 35 MPa,

f'cr = f'c + 8.3 MPa

c. If the specified compressive strength f'c is over 35 MPa,

f'cr = f'c + 9.7 MPa

1.8.4 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent

greater than the specified flexural strength at all times.

1.9 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.10 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.10.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.10.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.10.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.10.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not

prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II low alkali. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing. White Type III shall be used for the colored polished concrete floor specified in SECTION 03312.

2.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to 8percent, low alkali. Type III cement shall be used only in isolated instances and only when approved in writing.

2.1.3 Pozzolan (Fly Ash)

ASTM C 618, Class Cor F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material. Only one class of pozzolan from a single source shall be used. Weigh fly ash separately from cement.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S. Maximum aggregate size shall be 19mm for slabs and walls and 25mm for footings (see paragraph 1.6.6).

2.2.3 Aggregate for Polished Concrete Floor

Surfaced applied aggregate for polished concrete floor shall be as

specified in SECTION 03312.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer (Super Plasticizer)

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies. Superplasticizers shall be batch plant added, extend rehoplastic time, maintain setting characteristics similar to normal concrete throughout the recommended dosage range at varying concrete temperatures, reduce water 30 to 40 percent and give higher early and ultimate strengths.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.4.4 Polished Concrete Floor

Curing materials for polished concrete floor shall be as specified in SECTION 03312.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107and shall be a commercial formulation suitable for the proposed application. Grout shall be pre-packaged, mixed, placed and cured as recommended by the manufacturer. It shall have a minimum strength of 17 MPa at 1 day, 31 MPa at 7 days and 48 MPa at 28 days.

2.7 NONSLIP SURFACING MATERIAL

Nonslip surfacing material shall consist of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the 0.6 mm (No. 30) sieve to particles passing the 2.36 mm (No. 8 sieve).

2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C

1059.

2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel. Headed studs shall conform to ASTM A108, Grade 1010 to 1020, welded deformed bars shall conform to ASTM A496.

2.11 PERIMETER INSULATION and UNDER SLAB INSULATION

Perimeter insulation and under slab insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

2.12 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm (6 mils) or other equivalent material having a vapor permeance rating not exceeding 30 nanograms per Pascal per second per square meter (0.5 perms) as determined in accordance with ASTM E 96.

2.13 JOINT MATERIALS

2.13.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751 or ASTM D 1752. Materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

2.13.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

2.14 SYNTHETIC FIBERS FOR REINFORCING

Synthetic fibers, where noted on drawings or specifications, shall conform to ASTM C 1116, Type III, Synthetic Fiber, and as follows. Fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.9,

a minimum tensile strength of 480 MPa graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Fibers shall be added at the batch plant. A qualified technical representative shall instruct the concrete supplier in proper batching and mixing of materials to be provided. For colored polished concrete floor as specified in SECTION 03312, synthetic fibers for reinforcement shall not be used.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted. Earthwork shall be as specified in Section 02315 Excavation, Filling and Backfilling for Buildings.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next lift.

3.1.2.1 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 300 mm. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 50 mm wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 100 mm layer of trimmable, compactible fill (not sand) according to ACI 302.1 shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering fill.

3.1.4 Perimeter Insulation and Under Slab Insulation

Perimeter insulation and under slab insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 300 mm of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

3.2.1.1 General

The batching plant shall be located on site or off site close to the project. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for

admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation.

SECTION 03312

COLORED POLISHED CONCRETE FLOOR

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Scope

This section includes colored polished concrete floors as indicated or scheduled (with mark: CPC). Work includes providing, installing and finishing a custom colored polished concrete floor system and associated cleaning, preparation, sawcutting, sealing and protection, coordination with concrete supplier and related trades and other actions necessary for a complete surface. Because colors, aggregates and surface finish will vary with the manufacturer's system, installer and actual installation techniques used, finalizing the design of the approved surface appearance shall take place during the construction period. Contractor shall allow for several iterations of samples and mock-up to arrive at approved finishes.

1.1.2 Related Sections

Section 03200 Concrete Reinforcement
Section 03300 Cast-in-Place Structural Concrete
Section 03330 Cast-in-Place Architectural Concrete
Section 15750 Radiant Floor Heating and Cooling System

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 301	(1999) Specifications for Structural Concrete for Buildings
ACI 318M/318RM	(2002) Metric Building Code Requirements for Structural Concrete and Commentary

ACI 347	(2001) Guide to Formwork for Concrete
ACI SP-66	(1994) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM C 131	(2003) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 779/C 779M	(2000) Abrasion Resistance of Horizontal Concrete Surfaces
ASTM C 805	(2002) Rebound Number of Hardened Concrete
ASTM C 94	(1999) Ready-Mixed Concrete
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

1.3 GENERAL REQUIREMENTS

All materials, procedures, and requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE shall fully apply to polished concrete floors, except as otherwise specified.

1.3.1 Design Requirements

1.3.1.1 Concrete Mix

The concrete mix shall follow the basic requirements indicated in 03300 Cast-in-Place Structural Concrete, and be designed in accordance with ACI 211.1 and ACI 211.2. The mix design shall include consideration of the finishes required. White cement shall be used to lighten the overall color matrix, promote visual translucence and avoid darkening colors.

1.3.1.2 Formwork Design

Formwork design shall conform to ACI 301 and ACI 347.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Polished Concrete; G.

Detail drawings showing details conforming to ACI SP-66 and ACI 318M/318RM. Detail drawings shall show location of cast-in-place elements in the work, building elevations, formwork fabrication details, reinforcements, embedments, dimensions, concrete strength, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, stripping, and finishing. Indicate position of all joints, including joints provided only for aesthetic purposes.

SD-03 Product Data; G

Provide manufacturer's information for all materials and polished concrete system application methodology. Specifically explain how minimum floor flatness of 50 and minimum levelness of 30 shall be achieved.

SD-04 Samples

Materials; G.

Materials listed below, which shall indicate sizes, shapes, finishes, color, and pertinent accessories:

cementitious materials
aggregates
integral colorants
chemical stains for concrete
dyes for concrete

Appearance Samples; G.

Appearance samples shall be at least 200 mm long by 200 mm wide with sufficient thickness to contain the aggregates used in actual building conditions for each type of polished concrete and finish. Samples shall include typical joints to be used in the floor and actual joint finishes. Samples shall be submitted and approved prior to creation of mock up panels. Samples will be used as job standards for evaluation of mock up panels. Contractor shall assume fabrication, submittal and resubmittal of up to 3 samples for each color and finish of floor. Appearance alone will be sufficient justification for government rejection of a sample.

Mock Up Panels; G.

Separate mock up panels as described below shall be provided to demonstrate each polished concrete surface color, aggregate blend, texture and finish as required by the design. Panels shall be at least 3 000 mm long by 3 000 mm wide and full design thickness. Approved mock up panels shall be retained and protected on site for the duration of the project and serve as a standard of appearance and workmanship. Rejected mock up panels shall be demolished and removed from the site.

SD-05 Design Data; G

Concrete mix design(s). Include alternative mix designs when characteristics of materials, project conditions, test results, or other variables may require adjustments to the initial mix.

SD-06 Test Reports; G

Provide copies of reports signed by authorized official of qualified testing agency indicating and interpreting test results for compliance of materials with requirements indicated.

SD-07 Certificates; G

Provide statements signed by manufacturers certifying that the following materials comply with specified requirements:

cementitious materials
aggregates
admixtures
integral colorants
chemical stains
dyes

Provide statements signed by manufacturer certifying that the lead installer and installation crew have the level of experience specified and are approved for this installation.

SD-12 LEED Documentation

Recycled Content; G
Manufacturing Plant Location; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where products were produced in accordance with LEED-NC RG.

1.5 QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance with the contract requirements for colored polished concrete floors. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in a manner approved by the Contracting Officer. Quality control observations and inspections shall be documented and a copy of documentation furnished to the Contracting Officer within 24 hours following observations, inspections or tests.

1.5.1 Installer Qualifications

Lead installer shall have at least 6 years recent experience in the placement and finishing of floor systems of the size and type required for

this project. Provide locations, photos and point of contact phone number of at least three floor systems similar to this project; previous installations in the Puget Sound region preferred. Remainder of installation crew shall have at least 2 years experience on similar installations.

1.5.2 Concrete Supplier Qualifications

Ready-mix manufacturer shall comply with ASTM C 94 for production facilities and equipment.

1.5.3 Source Limitations

Each type or class of cementitious material shall be of the same brand and from the same manufacturer's plant. Each aggregate type shall be from a single source. Each color additive used, regardless of type, shall be from the same manufacturer's batch for the entire project.

1.5.4 Concrete Testing Service

An independent concrete testing service shall be employed for all material evaluations and concrete mix design testing.

1.5.5 Design/Submittals Meeting

Within 45 days following contract award, and prior to preparation of any submittals, a design completion/submittals meeting shall be held to discuss and coordinate colored polished concrete finishes. The specific system(s) of the proposed manufacturer and installer shall be reviewed for conformance with the design and integrated with project design requirements. Options for mix design, aggregates, coloring systems and polishing methodology shall be discussed. Attendance by contractor, installer, manufacturer's representative, Fort Lewis representative(s), government construction administrators, and project designers is required.

1.5.6 Mock Up Panels

Mock up panels shall be cast to demonstrate typical pattern; surface finish and texture; aggregate size, distribution and color; stain and dye color(s); and standard of workmanship. Mock ups shall be constructed with segments to illustrate the appearance of a variety of polish levels, such as 400, 800 and 1200 grit so the Contracting Officer can confirm level of polish required. Mock ups shall be built on site in a location as directed by the Contracting Officer and in an area that can be protected and remain undisturbed for the duration of the projected without significantly impacting other work. Provide at least 7 days advanced notice of mock up placement. Appearance samples shall be approved before mock ups are started. Mock ups shall be approved before permanent construction is started. Approved mock up panels will be used as a standard to judge the work. Rejected mock up panels shall be demolished and removed from the site.

1.5.7 Preinstallation Conference

Preinstallation conference shall be held on site at least one week prior to the start of floor installation. Confirm preparation and coordination required for installation with all trades involved. Present and discuss sequence for preparation, placement, cure, finishing and protection of colored polished concrete floors.

1.6 SURFACE PROTECTION

Concrete surfaces shall be protected from staining, contamination and mechanical damage at all times. Provide protective materials that will not affect the color or finish of floor surfaces. Hydraulic equipment shall only be used on concrete floors when a liquid barrier is present and the equipment is diapered to contain leaks. Do not park motor vehicles on slabs. Do not utilize pipe cutting or welding equipment on slabs. Do not store ferrous materials, or other potentially corroding or leaching substances on slabs. Avoid the application of caulks, sealants and mastics until completion of the floor system. Use breathable, colorfast cloth tarps overlayed with wood or masonite panels to minimize contamination and damage.

1.7 STORAGE AND DELIVERY

Materials shall be delivered and stored in manufacturer's packaging bearing original labels listing brand name, batch/lot number, and directions for storage, mixing, and application. All materials shall be stored under cover with temperature and humidity control as required by manufacturer. Maintain factory seals until used. Maintain a record of package number and product codes used in the work.

1.8 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for colored polished concrete products.

1.9 ENVIRONMENTAL CONDITIONS

Do not begin floor installation until ambient site environment is within the limitations established by the manufacturer and will remain within those limitations for the duration of the cure and finishing period. Verify that substrate temperature and moisture content, and ambient temperature, humidity and ventilation are all within approved ranges.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Surface applied aggregates shall conform to the system manufacturer's requirements for a polished floor system. Aggregates shall consist of stone, marble and recycled glass chips to produce an open matrix appearance

similar to terrazzo with aggregates between 3 and 10 mm forming approximately 40 percent of the surface area. Colors shall be black, tan, gray, orange and red to blend with chemical stains and/or dyes used.

2.1.1.1 Marble

Marble chips shall not exceed 40% loss for abrasion and impact resistance when tested in accordance with ASTM C 131. Marble chips shall not exceed a 0.75 percent 24 hour absorption rate, shall contain no deleterious or foreign material, and the dust content shall be less than one percent by weight.

2.1.1.2 Recycled Glass Chips/Beads

Recycled glass chips shall range from NTMA Standard No. 0 to No. 2. Glass chips shall not exceed 40% loss for abrasion and impact resistance when tested in accordance with ASTM C 131. Glass chips shall not exceed a 0.75 percent 24 hour absorption rate, shall contain no deleterious or foreign material, and the dust content shall be less than one percent by weight.

2.1.2 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 25 mm or less.

2.1.3 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

2.1.4 Plates, Angles, Anchors, and Embedments

Plates, angles, anchors, and embedments shall conform to ASTM A 36/A 36M, and shall be prime painted with inorganic zinc primer.

2.1.5 Formwork

Formwork for special effects shall be as approved.

2.1.6 Form Release Agents

Form release agents shall be manufacturer's standard, nonstaining, nonpetroleum based, compatible with surface color finish system.

2.1.7 Integral Colorants

Use of slab integral color is optional. If used, integral color shall not provide the only source of added color, but shall provide a muted base tint. Provide colorants intended for inclusion with delivered concrete mix, formulated to ensure even color distribution and recommended for use in polished concrete floor systems. Disintegrating bags shall not be introduced into the concrete mix. Reference products include:

Davis Colors Pigments by Davis Colors
Bomanite Integral Colors by Bomanite Corporation

Chromix by L.M. Scofield Company

2.1.8 Chemical Stains

Provide chemical stains intended for surface application, formulated to ensure surface penetration, color and wear durability and recommended for use in polished concrete floor systems. Reference products include:

Bomanite Chemical Stain by Bomanite Corporation
Lithochrome Chemstain Classic by L.M. Scofield Company
Kemiko Stone Tone Stain by Kemiko Concrete Products

2.1.9 Color Hardener

Use of color hardener is optional. If used, color hardener shall not provide the only source of added color, but shall provide a method of introducing a color pattern effect. Provide color hardeners intended for application to concrete floor systems, formulated to ensure color retention and recommended for use in polished concrete floor systems. Reference products include:

Bomanite Color Hardener by Bomanite Corporation
Lithochrome Color Hardener by L.M. Scofield Company
DCI Color hardener by Decorative Concrete Impressions

2.1.10 Color Dyes

Use of color dyes is optional. If used, color dyes shall not provide the only source of added color, but shall provide a method of introducing a color accent or pattern effect. Provide color dyes intended for application to concrete floor systems, formulated to ensure color retention and recommended for use in polished concrete floor systems. Dyes may only be used as specifically approved. Reference products include:

DecoTone by Decosup Inc.
Super Stone Concrete Dye by Super Stone Inc.
Dye Coloring by Advanced Surfaces

2.1.11 Hardening/Sealing Agent

Hardening/Sealing Agent, if required by the system used, shall provide the following characteristics. Provide abrasion resistance increase per ASTM C 779/C 779M of at least 300 percent. Increase impact strength per ASTM C 805 of at least 15 percent. Provide at least a 20 percent increase in reflectivity. Exceed OSHA and ADA recommendations for the co-efficient of friction per ASTM C 1028.

2.1.12 Surface Sealer

Surface sealer shall be an internal, impregnating type that is colorless, non-yellowing and generally invisible to the eye. Application rate and number of coats as recommended by floor system manufacturer.

2.1.13 Water

All water used in concrete and process applications shall be potable and meet ASTM C 94.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

Formwork shall be erected in accordance with the detail drawings to ensure that the finished concrete members conform accurately to the indicated dimensions, lines, elevations, and finishes. Form lines shall be installed as necessary to provide the required finish. Use of form release agents shall be reviewed/tested to verify no deleterious effects on finishes before it is used. Formwork shall conform to ACI 301 and ACI 347.

3.2 EXAMINATION

Verify that subgrade, reinforcement, items to be cast-in-place and hydronic heating components (where applicable) are prepared and installed as designed and approved and are consistent with a successful polished concrete floor installation. Following slab placement and prior to color and polish activities, verify that surface is clear of any latency, dirt, dust, grease, paint, curing compounds, sealers or other foreign material. Floor system manufacturer's technical representative shall be present for all examinations of substrate and concrete surfaces.

3.3 CONCRETE FINISHES

Design intent is to provide a colored and polished concrete surface providing visual interest, a surface aggregate appearance similar to terrazzo, near imperviousness to "walk-off" of color, and a very low requirement for maintenance (periodic damp mopping). Concrete finishes shall conform to the approved system, appearance samples and mock up panels. Initial finishing shall be accomplished at the time of concrete placement or immediately after formwork removal. Colored and polished concrete floors shall be accomplished by using the approved sequence of procedures and materials.

3.3.1 Finish CPC-1

Finish shall be polished concrete with a base color of "Pine", layered accent colors of "Auburn" and "Rust Red" and a custom blended seeded aggregate mix with at least 3 marble colors and 2 glass colors. Seeded aggregate in total shall provide approximately 40% surface coverage. Design intent is to provide a surface with a muted base color and swirling, overlayered accent colors. Color and aggregate patterns shall be irregular. Surface shall be semi-gloss to glossy in character.

3.3.2 Finish CPC-2

Finish shall be polished concrete with a single color of "Auburn" and a custom blended seeded aggregate mix with at least 3 marble colors and 2 glass colors. Seeded aggregate in total shall provide approximately 40% surface coverage. Surface shall be semi-gloss in character.

3.4 PREPARATION

Protect adjacent construction from discoloration and spillage during installation of concrete, stains, hardeners, curing compounds and sealers. Protect all adjacent construction from damage during grinding and polishing operations and contamination from grinding dust or slurry.

3.5 PLACEMENT

Manufacturer's technical representative shall be present at initial placement of each type of floor surface. Place concrete consistent with requirements for slabs contained in SECTION 03300 Cast-in-Place Structural Concrete. Float and trowel the floor to produce a finish consistent with the floor system being used. At minimum, produce a concrete floor with flatness of at least 50 and levelness of at least 30.

3.6 COLORED AND POLISHED FINISH

3.6.1 Aggregate Seeding

Immediately after floating, broadcast aggregate mix to form a surface layer of decorative aggregates. Tamp and float into the surface to ensure full embedment and depth necessary to sustain polishing actions. Apply and work into surface in the manner required to produce the same visual effect as the approved mock up panels.

3.6.2 Curing Compound

Curing compounds, if used, shall be formulated to not interfere with method(s) used to introduce surface color to the floor after concrete cure period. Avoid the use of liquid membrane cures or plastic sheeting.

3.6.3 Grinding and Polishing

Concrete shall have been in place for a minimum of 28 days, or longer per manufacturer's recommendation prior to beginning any grinding activity. Either dry or wet grinding/polishing shall be acceptable. Dry processes shall utilize vacuum capture of particulates. Slurry produced by wet grinding shall be captured and disposed off site. Grinding and polishing shall be performed with multiple passes of successively finer diamond impregnated abrasive disks. Final polish for areas of gloss finish shall be at least 1500 grit. Consistently remove dust and debris during and between polishing stages. Final polishing shall include the use of a commercial polishing compound. Polishing shall match the sheen values specified and as demonstrated on the mock up panels. Polishing level at entrance lobbies shall be lowered consistent with best practices for potentially wet surfaces.

3.6.4 Chemical Stain Application

Clean surface of any materials listed in paragraph 3.1. Use water and detergent in combination with a buffing machine and wet vacuum to clean and extract all excess water. Surface shall be clean and free of any marking,

streaks, footprints and contaminants. Apply chemical stains as recommended by the manufacturer and as required to produce the effects demonstrated on the approved mock up panels. Where colors change on opposite sides of doors, apply colors such that only one is visible when the door is closed.

3.6.5 Organic/Inorganic Dyes

Dyes manufactured for use on concrete may be used in addition to chemical stains to produce color and pattern variegations, or to adjust inadequate performance of stains. Dyes shall be diluted as necessary to maintain muted coloration consistent with the intensity of applied stains.

3.7 SAW CUT JOINTS

Saw cutting of joints and pattern lines shall be scheduled and performed as specified in SECTION 03300 Cast-in-Place Structural Concrete. Carefully and thoroughly clean dust and sawing slurry from joints to avoid affecting stain colors.

3.8 JOINT SEALING

Joint sealing shall be as specified in Section 07920 JOINT SEALANTS.

3.9 CLEANING

Keep the work area clear of debris and contaminants at all times. Remove spatter from adjacent surfaces. Replace all surfaces that cannot be cleaned or otherwise restored to unblemished condition. No sooner than 72 hours after joints are sealed, faces and other exposed surfaces of polished concrete shall be washed down, cleaned with soap and water applied with a soft bristle brush, then washed down again with clean water, or by other approved procedures. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Care shall be taken during cleaning operations to protect adjacent surfaces from damage.

3.10 SURFACE SEALING

After cleaning, concrete surfaces requiring a surface sealant shall be coated with the required number of coats of surface sealer, spray applied unless otherwise approved. Adjacent surfaces shall be protected to prevent damage from the surface sealer. Protect floor from traffic for a minimum of 24 hours or longer as recommended by manufacturer.

3.11 PROTECTION OF WORK

The concrete slab shall be protected after placement to ensure that contaminates do not affect future color application. Following completion of the floor system, work shall be protected against damage from subsequent operations. Protection shall include a physical barrier such as masonite or similar hardboard sheets and shall remain until all construction operations that could harm the floor system have been concluded.

3.12 DEFECTIVE WORK

Defective work shall be repaired or replaced, as directed by the Contracting Officer, using approved procedures. Significant aesthetic variations from approved mock up panels will constitute defective work.

-- End of Section --

SECTION 03330

CAST-IN-PLACE ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.1 SUMMARY

This section applies to concrete exposed to view in finished construction in the Chapel and Storage Building at the following locations:

Foundation walls - exposed exterior surfaces
Interior floors not indicated as Colored Polished Concrete and concrete stair treads and landing at Mechanical Equipment Platform
Exterior concrete walkways
Concrete walls - exposed at dumpster enclosure

Colored Polished Concrete floors are specified in Section 03312.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 301	(1999) Specifications for Structural Concrete for Buildings
ACI 303R	(1991) Guide to Cast-in-Place Architectural Concrete Practice
ACI 315	(1999) Details and Detailing of Concrete Reinforcement
ACI 318M/318RM	(2002) Metric Building Code Requirements for Structural Concrete and Commentary
ACI 347R	(2001) Guide to Formwork for Concrete
ACI SP-66	(1994) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 GENERAL REQUIREMENTS

All materials, procedures, and requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE shall fully apply to cast-in-place architectural concrete, except as otherwise specified in this section.

1.3.1 Design Requirements

1.3.1.1 Concrete Mix

Concrete mix shall conform to requirements for Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mix shall be designed in accordance with ACI 211.1 and ACI 211.2. The mix design shall include consideration of the finishes required.

1.3.1.2 Formwork Design

Formwork design shall conform to ACI 301 and ACI 347R.

1.3.1.3 Sustainable Design

Regional Materials (LEED MR 5.1)

Concrete shall be manufactured within 500 miles of project site in accordance with LEED-NC RG.

Recycled Content (LEED MR 4.1 & 4.2)

Utilize recycled aggregate in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Architectural Concrete; G.

Detail drawings showing details conforming to ACI SP-66 and ACI 315 and ACI 318M/318RM. Detail drawings shall show location of

cast-in-place elements in the work, building elevations, formwork fabrication details, reinforcements, embedments, dimensions, concrete strength, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, stripping, and finishing.

SD-04 Samples

Materials; G
Surfaces; G

Materials listed below, which shall indicate sizes, shapes, finishes, color, and pertinent accessories:

Surfaces representing foundation wall construction shall be incorporated with the mock up walls required by Section 04850 NONBEARING MASONRY VENEER/WOOD STUD WALLS. Walls shall include a typical joint between form panels, form tie conditions and finishes. Color samples on concrete shall include all system components such as sealers. Sample surfaces shall not be incorporated in the finished work, but shall be located on site for easy visual reference. Surfaces shall be protected from weather, and other damage until acceptance of work. Sample surfaces shall be used as job standards throughout construction.

SD-12 LEED Documentation

Recycled Content; G
Resource Reuse; G
Manufacturing Plant Location; G
Regional Material Extraction; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where concrete was produced, and percentage of the product's raw materials extracted regionally in accordance with LEED-NC RG.

1.5 INSTALLER EXPERIENCE

All personnel involved in the installation of architectural concrete surfaces shall have previously completed at least 5 projects of similar size and complexity. Lead personnel shall have a minimum of three years experience using the specific products and systems to be employed on this project.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of architectural concrete with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Sample panels are built and provided with all features of the wall construction as indicated.

(5) Inspection of all formwork prior to concrete placement.

(6) Protection of finished concrete from damage, surface contamination or staining resulting from the work of other trades.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall conform to requirements for Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Pigments for color added as indicated on drawings.

2.1.2 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 25 mm or less.

2.1.3 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

2.1.4 Plates, Angles, Anchors, and Embedments

Plates, angles, anchors, and embedments shall conform to ASTM A 36/A 36M, and shall be prime painted with inorganic zinc primer.

2.1.5 Formwork

Formwork for special effects shall be as approved.

2.1.6 Form Release Agents

Form release agents shall be manufacturer's standard, nonstaining, nonpetroleum based, compatible with surface sealer finish coating.

2.1.7 Surface Sealer (on exposed floors not receiving Colored Polished Concrete finish)

Surface sealer shall be methyl methacrylate polymer acrylic emulsion, clear color.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

Formwork shall be erected in accordance with the detail drawings to ensure that the finished concrete members conform accurately to the indicated dimensions, lines, elevations, and finishes. Deflection shall not exceed 1/360th of each component span or distance between adjacent supports. Deflections and tolerance shall not be cumulative. Form lines shall be installed as necessary to provide the required finish. Forms shall be coated with form release agents before reinforcement is placed. Formwork shall conform to ACI 301, ACI 347R and Section 03100 STRUCTURAL CONCRETE FORMWORK.

3.2 CONCRETE FINISHES

3.2.1 Finish Type by Location

Minimum finish for any exposed formed concrete is Class A. Minimum finish for floors is troweled. Stair treads shall be lightly broomed. In addition, special finishes shall be provided at the locations listed below, or as otherwise indicated, and shall conform to the requirements specified herein.

Foundation wall (exterior): Light sandblast finish

Exposed concrete walls (exterior) at dumpster enclosure: Class A finish in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Apply smooth finish as indicated in paragraph 3.2.2.1.

Interior Stairs (horizontal surfaces): Medium broom finish

Interior Floors (exposed in finished construction and not receiving Colored Polished Concrete finish): Troweled to a dense, smooth surface with applied surface sealer

3.2.2 Finish Method

Concrete finishes shall conform to the approved finish samples. Finishing shall be accomplished at the time of concrete placement or immediately after formwork removal. Cast-in-place concrete elements which are to have a finish other than the surface produced from standard formwork, shall be accomplished by using the following procedures:

3.2.2.1 Smooth Finish

After other concrete construction is complete and each contiguous area of the structure is in final form, smooth finish shall be applied to the areas indicated on drawings and/or listed in this section. A mortar mix consisting of one part Portland cement and two parts well-graded sand

passing a 0.6 mm No. 30 sieve, with water added to give the consistency of thick paint, shall be used. Where the finished surface will not receive other applied surface, white cement shall be used to replace part of the job cement to produce an approved color, which shall be uniform throughout the surfaces of the structure. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads having on their surface the same sand-cement mix specified above but without any mixing water, until all of the visible grout film is removed. The burlap pads used for this operation shall be stretched tightly around a board to prevent dishing the mortar in the voids. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours commencing immediately after finishing operations in each area. The temperature of the air adjacent to the surface shall be not less than 10 degrees C for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas or at night, and shall never be applied when there is significant hot, dry wind.

3.2.2.2 Sandblast Finish

The concrete surface shall be blasted at an approved age with approved wet sandblasting procedures to obtain a light finish that will match the descriptive photographs in ACI 303R. The finish shall be similar to and shall closely match the finish on the approved pre-construction test panel fabricated by the Contractor. Protect adjacent materials from sandblast erosion or contamination.

3.3 JOINT SEALING

Joint sealing shall be as specified in Section 07920 JOINT SEALANTS.

3.4 CLEANING

No sooner than 72 hours after joints are sealed, faces and other exposed surfaces of cast-in-place concrete shall be washed down, cleaned with soap and water applied with a soft bristle brush, then washed down again with clean water, or by other approved procedures. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Care shall be taken during cleaning operations to protect adjacent surfaces from damage.

3.5 SURFACE SEALING

After cleaning, exterior exposed architectural concrete surfaces indicated shall be given one coat of surface sealer, spray applied unless otherwise approved. Adjacent surfaces shall be protected to prevent damage from the surface sealer.

3.6 PROTECTION OF WORK

Work shall be protected against damage from subsequent operations. Provide continuous protection of all acid stained surfaces against contamination by other construction materials.

3.7 DEFECTIVE WORK

Defective work shall be repaired or replaced, as directed, using approved procedures.

-- End of Section --

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SECTION 03413

PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.1 SUMMARY

This section applies to precast concrete in finished construction in the following locations:

Window sill blocks

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 318M/318RM	(2002) Metric Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(1994) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2002ae1) Portland Cement
ASTM C 1017/C 1017M	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 642	(1997) Density, Absorption, and Voids in Hardened Concrete

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116	(1999) Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-117	(1996) Quality Control for Plants and Production of Architectural Precast Concrete Products
PCI MNL-122	(1989) Architectural Precast Concrete

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 GENERAL REQUIREMENTS

Precast concrete units shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer certified under the PCI Plant Certification Program. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings for at least 3 years. The Contractor shall submit a statement detailing the Manufacturer's Qualifications as specified in the Submittals paragraph. Precast work shall be coordinated with the work of other trades.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Architectural Precast Concrete System; G

Detail drawings showing details in accordance with ACI SP-66 and ACI 318M/318RM, including installation details. Detail drawings shall indicate separate identification marks for each different precast unit, location of units in the work, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, blocking points for units stored at the precast concrete plant or at the jobsite, lifting points and special handling instructions in sufficient detail to cover manufacture, handling, and erection.

SD-03 Product Data

Calculations;

Design calculations, prior to the manufacture of any precast architectural concrete units for the project.

Mix Design; G

A statement on the mix design formula, as specified.

Manufacturer's Qualifications

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

SD-04 Samples

Precast Concrete Units; G

One full scale sample of each type of precast unit with finish required for the project. Samples shall show matrix color, surface color, surface texture, and panel back finish. A partial window sill unit shall be included in the sample panels required by Section 04850 NON-BEARING MASONRY VENEER/WOOD STUD WALLS.

SD-06 Test Reports

Materials

Certified copies of test reports including all test data and all test results. Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory, except that compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory.

SD-07 Certificates

Manufacturing Location Certification

Signed letter from manufacturer, certifying product was manufactured within 500 miles of the project site and listing percentage of the product raw materials extracted regionally in accordance with LEED-NC RG.

SD-12 LEED Documentation

Recycled Content; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content.

1.5 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for

concrete products.

1.6 DESIGN

1.6.1 Standards and Loads

Precast unit design shall conform to ACI 318M/318RM and PCI MNL-122. Design loads for precast concrete shall be as indicated on the drawings. A differential temperature of 89 degrees C, between interior and exterior faces of the units, shall be considered in the design. Stresses due to restrained volume change caused by shrinkage and temperature differential, handling, transportation and erection shall be accounted for in the design.

1.6.2 Connections

Connection of units to other members, or to other units shall be of the type and configuration indicated. The design and sizing of connections for all design loads shall be by the Contractor.

1.6.3 Concrete Strength

Precast concrete units shall have a 28-day compressive strength of 34 MPa .

1.6.4 Concrete Proportion

Selection of proportions for concrete shall be based on the methodology presented in ACI 211.1 for normal weight concrete and ACI 211.2 for lightweight concrete. The concrete proportion shall be developed using the same type and brand of cement, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Calcium chloride shall not be used in precast concrete.

1.6.5 Calculations

Calculations for design of members and connections not shown shall be made by a professional engineer experienced in the design of precast architectural concrete. Calculation shall include the analysis of member for lifting stresses and the sizing of the lifting inserts.

1.6.6 Mix Design

The Contractor shall submit the mix design formula giving the maximum nominal coarse aggregate size, the proportions of all ingredients and the type and amount of any admixtures that will be used in the manufacture of each strength and type of concrete, prior to commencing operations. The statement shall be accompanied by test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made without additional tests to verify that the concrete properties are satisfactory.

1.7 STORAGE AND INSPECTION AT MANUFACTURER'S PLANT

Precast units temporarily stored at the manufacturer's plant shall be

protected from damage in accordance with PCI MNL-116 and PCI MNL-117 and PCI MNL-122. Immediately prior to shipment to the jobsite, all precast concrete units shall be inspected for quality to insure all precast units conform to the requirements specified. Inspection for quality shall include, but shall not necessarily be limited to, the following elements: color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.

1.8 HANDLING AND STORAGE

Precast units shall be delivered to the site in accordance with delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite all precast units shall be inspected for quality as specified above. If the precast units cannot be unloaded and placed directly into the work, they shall be stored onsite, off the ground and protected from weather, marring, or overload. Precast units shall be handled in accordance with manufacturer's instructions.

1.9 MANUFACTURER AND INSTALLER EXPERIENCE

The precast manufacturer shall meet the following experience and capability requirements. If the installation contractor is a separate entity from the manufacturer, it shall also meet the same requirements.

(1) Regularly and presently fabricates and erects precast concrete architectural components as a principal product/service.

(2) Has a minimum of 3 years successful experience in the fabrication of architectural precast concrete units similar to the units required for this project (submit names of at least five previous projects).

(3) Possess sufficient production capacity to produce, transport and deliver the required units without causing delay in the work.

(4) Has a minimum of 2 years successful experience in the erection of precast units similar to the units required for this project.

1.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of precast concrete construction with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Precast concrete units meet all requirements for shape, size, strength, mix design, etc.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Precast concrete units are incorporated in sample panels with all features of the wall construction as indicated.

(6) Precast concrete unit installation is coordinated with interfacing construction to eliminate conflicts.

(7) Precast manufacturer meets all required qualifications for design and fabrication.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified, material shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and Section 03200 CONCRETE REINFORCEMENT.

2.1.1 Aggregates

Aggregates shall be as required to match finish / color specified on drawings.

2.1.2 Cement

Cement shall conform to ASTM C 150, Type I or Type III, as required to match finish / color specified on drawings. Cement shall be white for precast legs and supports of the men's and women's Wuzu benches.

2.1.3 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 25 mm or less.

2.1.4 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

2.1.5 Inserts

Inserts shall be manufacturer's standard, suited for the application.

2.1.6 Plates, Angles, Anchors and Embedments

Material shall be as specified in PCI MNL-117. Steel items, other than stainless, shall be coated with a rust-inhibiting paint or shall be hot-dip galvanized. Steel items, including items embedded in concrete, shall be either stainless steel or hot dip galvanized steel.

2.1.7 Form Release Agent

Release agent shall be manufacturer's standard nonstaining type.

2.1.8 Admixtures

Admixtures shall conform to ASTM C 494/C 494M. Plasticizing admixture, if used, shall conform to ASTM C 1017/C 1017M.

2.2 PRECAST CONCRETE UNITS

Precast concrete units shall be manufactured and cured in accordance with the applicable provisions of PCI MNL-117. Units shall be manufactured within the allowable tolerances given in PCI MNL-117 and PCI MNL-122.

2.2.1 Formwork

Forms shall be steel of adequate thickness, braced, stiffened, anchored and aligned to produce precast architectural concrete units within required dimensional tolerances. Forms shall be sufficiently rigid to provide dimensional stability during handling and concrete placement and consolidation. Fiberglass-reinforced plastic, plastic coated wood, elastomeric or other nonabsorptive material shall be used for making tight joints and rustication pieces.

2.2.2 Reinforcement

Fabrication and placement of reinforcement shall conform to the details shown on the approved detail drawings and PCI MNL-117.

2.2.3 Embedded Accessories

Anchors, inserts, lifting devices, and other accessories which are to be embedded in the precast units shall be furnished and installed in accordance with the approved detail drawings. Embedded items shall be accurately positioned in their designed location, and shall have sufficient anchorage and embedment to satisfy design requirements.

2.2.4 Stripping

Precast concrete units shall not be removed from forms until units develop sufficient strength to safely strip the formwork and to remove the precast concrete units from the forms to prevent damage to the units from overstress or chipping.

2.2.5 Identification

Each precast concrete unit shall be marked to correspond to the identification marks for each different precast unit shown on the detail drawings.

2.2.6 Finishes

2.2.6.1 Finish

All precast units shall have color and surface finish per exterior finish schedule.

2.2.6.2 Exposed Surfaces

Surfaces of precast units exposed to view or surfaces indicated to be finished shall be finished as follows:

(1) At unit terminations, edges and corner transitions, grind smooth form offsets and fins over 5-mm projection. Fill air holes and pockets over 5-mm diameter with sand cement paste. Complete prior to acid washing.

(2) All curved surfaces shall be free of flat spots or other surface irregularities.

(3) Unit surfaces exposed to view shall receive a medium acid wash. Acid wash procedures shall be as recommended in PCI Mnl-117, "Acid Etched", for a uniform surface appearance.

(4) Concealed concrete surfaces shall receive a standard "underside" finish. This shall be the normal plant run finish produced in forms that impart a smooth finish to the concrete. Small surface holes caused by air bubbles, normal form joint marks, monitor chips and spalls will be tolerated, but not major or unsightly imperfections, honeycomb or structural defects.

2.2.6.3 Other Surfaces

Surfaces of precast units not exposed to view or not otherwise indicated to be finished shall be finished in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.2.7 Liquid Water Repellant

Clear penetrating coating that reacts with concrete surfaces to form a chemical water repellent bond; water based alkylalkoxysilane (20 percent by weight); applied in the field by an applicator approved in writing by the material manufacturer in accordance with the manufacturer's directions. Coating shall have a water absorption rate of not more than 0.53 percent in 48 hours when tested in accordance with ASTM C 642. Coating shall not inhibit adhesion of sealants specified in Section 07920 JOINT SEALANTS.

PART 3 EXECUTION

3.1 INSPECTION

Contractor shall examine all portions of the supporting structure and the conditions under which the precast concrete work is to be erected and notify the Contracting Officer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 ERECTION

3.2.1 Prohibitions

Do not install precast concrete units until at least 5 days after casting. Do not use powder-actuated fasteners for surface attachment of accessory items in any precast unit. Do not block air cavity of masonry veneer walls. Do not attach precast legs and supports of men's and women's Wuzu benches to the floor.

3.2.2 Installation

Precast units shall be erected in accordance with the detail drawings and without damage to other units or to adjacent members. Units shall be set true to alignment and level, with joints properly spaced and aligned both vertically and horizontally. Erection tolerances shall be in accordance with the requirements of PCI MNL-117 and PCI MNL-122. As units are being erected, shims and wedges shall be placed as required to maintain position, stability and correct alignment. After final attachment, precast units shall be grouted as shown on detail drawings. After erection, welds and abraded surfaces of steel shall be cleaned and touched-up with a zinc-rich paint. Welds shall be made by a certified welder in accordance with the manufacturer's erection drawings. Pickup points, erection aids, boxouts, inserts, and similar items shall be removed as necessary and finished to match adjacent areas after erection. Hardware shall be recessed on any surfaces exposed at completion. Erection of precast units shall be supervised and performed by workmen skilled in this type of work. Welding and the qualifications of welders shall be in accordance with AWS D1.1/D1.1M.

3.2.3 Precast Components in Masonry Veneer Walls

Precast units used in conjunction with masonry construction shall be sized to meet the dimensional modules of the adjacent masonry. Provide expansion joints where precast units cross similar joints in masonry construction. Precast units shall be incorporated in construction concurrently with adjacent masonry units. Joints between precast and masonry units shall be masonry mortar with matching surface strike. Anchor precast units to steel studs or structural members using methods similar to those required for masonry and incorporating the same tolerances and requirements for movement as masonry veneer anchors.

3.3 JOINT SEALING

Joint sealing shall be as specified in Section 07920 JOINT SEALANTS.

3.4 APPLICATION OF LIQUID WATER REPELLENT

Apply repellant after completion of adjoining elastomeric sealant work and initial cleaning of units. Apply material in accordance with manufacturer's printed instructions. Mask adjacent areas to avoid contamination of masonry, glass, EIFS and other adjacent surfaces. After 21 days, spray water on coated surfaces and recoat any absorptive surfaces.

3.5 CLEANING

Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast concrete discolored during erection shall be cleaned to remove dirt and stains by dry scrubbing with a stiff fiber brush, wetting the surface and vigorous scrubbing of the finish with a stiff fiber brush followed by additional washing, or by chemical cleaning compounds such as detergents or other commercial cleaners. Do not use cleaning materials or processes that could change the character of exposed concrete surfaces. Commercial cleaners shall be used in accordance with the manufacturer's recommendations. Cleaning procedure shall be performed on a designated test area and shall be approved prior to proceeding with cleaning work. Discolorations which cannot be removed by these procedures, will be considered defective work. Cleaning work shall be done when temperature and humidity permit surfaces to dry rapidly. Adjacent surfaces shall not be damaged during cleaning operations.

3.6 PROTECTION OF WORK

Precast units shall be protected against damage from subsequent operations.

3.7 DEFECTIVE WORK

Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required. Precast concrete units that do not conform to the specified requirements, including strength, tolerances and finishes, shall be replaced with conforming units. Precast concrete units damaged during erection shall be repaired as soon after occurrence as possible or replaced, as directed by Contracting Officer, using approved procedures. All repairs to precast concrete units shall match the adjacent surfaces in color and texture and shall be as approved. Unless otherwise approved, repair procedures shall conform to PCI MNL-117. In-place precast units may be rejected for any one of the following:

(1) Exceeding the specified installation tolerances.

(2) Damage during construction operations.

(3) Exposed to view surfaces that develop surface finish deficiencies.

(4) Patching work visible from ground or through windows.

(5) Other defects as listed in PCI Mnl-117.

-- End of Section --

SECTION 04850

NONBEARING MASONRY VENEER/WOOD STUD WALLS

PART 1 GENERAL

1.1 SCOPE OF WORK

Masonry construction specified in this section includes brick veneer on wood stud walls and incidental brick veneer on concrete walls (dumpster enclosure).

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-971-Spec	(1996) Specification and Commentary for the Design of Cold-Formed Steel Structural Members and Commentary; includes SG-2000-1 Supp 1 to 1996 Spec, dated 2000

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 316	(1989) ASD Manual of Steel Construction

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.6.1	(1981; R 1997) Wood Screws (Inch Series)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and

	Steel Hardware
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 82	(2002) Steel Wire, Plain, for Concrete Reinforcement
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM C 1072	(2000a) Measurement of Masonry Flexural Bond Strength
ASTM C 216	(2003a) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2003) Mortar for Unit Masonry
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 67	(2003a) Sampling and Testing Brick and Structural Clay Tile
ASTM C 780	(2002) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 91	(2003a) Masonry Cement
ASTM D 1330	(1985; R 2000) Rubber Sheet Gaskets

U.S. DEPARTMENT OF COMMERCE (DOC)

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as

otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Detail drawings as specified.

SD-03 Product Data

Clay or Shale Brick; G
Insulation; G
Flashing; G
Water-Repellant Admixture; G

SD-04 Samples

Expansion Joint Materials; G
Clay or Shale Brick; G
Sample Panel; G

A portable panel, approximately 600 by 600 mm, containing approximately 12 brick facings to establish the range of color and texture. One of each type of masonry veneer anchor used.

SD-05 Design Data

Masonry Veneer/Wood Stud Wall System; G

For any revisions to the indicated design, provide calculations demonstrating structural adequacy of wood framing to meet the strength and deflection criteria specified.

Provide calculations demonstrating the structural adequacy of undesignated steel lintels and shelf angles for the calculated gravity loads being supported; this analysis shall be in accordance with AISC 316. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval. Minimum out of plane wind loading shall be per ASCE 7-02 "Components and Cladding" seismic loading per TI-809-04.

Calculations demonstrating the insulation shown on the drawings provides the specified U-value for heat transmission of the completed exterior wall construction; this analysis shall be in accordance with ASHRAE Hdbk-IP. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

SD-06 Test Reports

Veneer Anchors; G

Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval.

SD-07 Certificates

Clay or Shale Brick;
Joint Reinforcement;
Expansion Joint Materials;
Cavity Insulation;
Exterior Sheathing;
Air and Moisture Barrier;
Veneer Anchors;
Welding;

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

SD-12 LEED Documentation

Recycled Content; G,
Manufacturing Plant Location; G,
Regional Material Extraction; G,

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where masonry veneer was produced, and percentage of the product's raw materials extracted regionally in accordance with LEED-NC RG.

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for masonry products.

1.5 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

1.5.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the

wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2500 mm long by 1800 mm high.

1.5.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The panel shall also show wood framing, cavity insulation, plywood sheathing, air and moisture barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. The Contractor's method for mortar joint tooling and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, brick expansion joints, cavity insulation, flashing, brick soldier and row lock courses and weep holes shall be shown in the sample panels. Panels shall show installation of electrical boxes and conduit and mechanical or plumbing devices. Panels shall contain a minimum 600 by 600 mm opening placed at least 600 mm above the panel base and 600 mm away from all free edges, corners, and control joints. Required reinforcing and lintels shall be provided around this opening as well as at wall corners and control joints. Opening shall include a window mockup and shall demonstrate the connection of the window to the wall construction as required to meet anti-terrorism loading conditions specified in SECTION 08520 ALUMINUM WINDOWS.

1.5.3 Construction Method

The Contractor shall demonstrate and receive approval for the method of construction. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

1.5.4 Usage

The completed panel(s) shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.6 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall

be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Cavity insulation, air and moisture barrier, and plywood sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat.

1.7 EFFLORESCENCE TESTS

1.7.1 Brick

Efflorescence tests shall be performed by an approved commercial testing laboratory. Sampling for the tests shall be the responsibility of the Contractor. Brick shall be sampled and tested for efflorescence in accordance with ASTM C 67 and the rating shall be: "not effloresced".

1.7.2 Mortar

A specimen of each proposed mix of mortar, weighing approximately 3 ounces, shall be prepared using as little water as possible. While still in the plastic condition and prior to the initial set, each mortar specimen shall be placed in a glass or glazed receptacle, and 4 ounces of distilled water shall be mixed with the specimen and stirred thoroughly for 5 minutes. The receptacle shall be of such a size that when the mortar specimen and water are combined in solution, and a brick is placed into it, the solution will have a depth of one half inch to 1 inch. A brick, that has been tested and found free of efflorescence, shall be placed on end in the solution and the water level maintained at one half inch to 1 inch with distilled water. After continuous contact with the solution, indoors at a temperature range of 75 degrees F, plus or minus 15 degrees for 7 days, the masonry unit shall be removed from the solution and air-dried for 24 hours. The masonry unit shall be compared with an untreated unit and if the difference due to efflorescence is noticeable when viewed at a distance of 10 feet, the components of the mortar mix shall be tested independently. Cementitious components shall be prepared for testing by thoroughly mixing 1 ounce of the cementitious material with 4 ounces of distilled water. Aggregate components shall be prepared for testing by thoroughly mixing 3 ounces of the aggregate component with 4 ounces of distilled water. Each mixture shall be tested as specified above for the proposed mix. The component causing efflorescence shall be rejected. Testing cycle shall be repeated with new component(s) until successful.

1.8 DETAIL DRAWINGS

The Contractor shall submit details of framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds. If the Contractor opts to furnish inch-pound (IP) masonry products, drawings showing elevation of walls exposed to view and indicating the location of all cut masonry products

shall be submitted for approval.

1.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of masonry with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Brick meets all requirements for shape, size, strength, etc.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Sample panels are built and provided with all features of the wall construction as indicated.

(6) Masonry installation is coordinated with interfacing construction to eliminate conflicts.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 VENEER WYTHE

The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval. The Contractor has the option to use either hard metric or substitute inch-pound (soft-metric) masonry products. If the Contractor decides to substitute inch-pound masonry products, the following additional requirements shall be met:

a. The dimensions indicated on the drawings shall not be altered to accommodate inch-pound masonry products either horizontally or vertically. The 100 mm building module shall be maintained, except for the actual physical size of the masonry products themselves.

b. Mortar joint widths shall be maintained as specified.

c. Indicated reinforcing bar spacing shall not be exceeded. Inch-pound masonry products shall accommodate reinforcing bar placement. Reinforcing bars shall not be cut, bent or eliminated to fit into the inch-pound masonry product modules.

d. Masonry inch-pound products shall not be reduced in size by more than one-third (1/3) in height and one-half (1/2) in length. Masonry products shall not be cut at ends of walls, corners, and other openings.

e. Cut, exposed masonry products shall be held to a minimum and shall be located where they will have the least impact on the aesthetics of the facility.

f. Other building components built into the masonry products, such as window frames, door frames, louvers, fire dampers, etc., that are required to be metric, shall remain metric.

g. Additional metric guidance shall conform to Section 01415 METRIC MEASUREMENTS.

2.1.1 Clay or Shale Brick - Metric Modular

Clay or shale brick veneer shall be masonry units conforming to ASTM C 216, Type FBS. Color range and texture shall be as indicated and shall conform to the approved sample. Grade SW shall be used for all brickwork. Brick unit sizes shall be modular and the nominal size of the brick used shall be 90 mm thick, 57 mm high, and 190 mm long (metric modular). Minimum compressive strength of the brick shall be 17.2 MPa for individual brick, 20.7 MPa for average of 5 brick.

2.2 PRECAST CONCRETE ITEMS

Trim, ornaments, wall caps and window sills shall be factory-made units conforming to Section 03413 PRECAST ARCHITECTURAL CONCRETE

2.3 MORTAR

Mortar shall conform to ASTM C 270, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content, be "non-staining" and be of one brand. Aggregates shall be from one source.

2.3.1 Masonry Cement

Masonry cement in conformance with ASTM C 91 may be used in the mortar. When using a masonry cement a comparative test shall be performed between a Portland cement-lime mortar and the masonry cement mortar proposed for the project to evaluate the ASTM C 1072 bond and the ASTM C 780 compressive strength of the two mixes. The test shall be conducted with the proposed masonry units for the project. The masonry cement mortar will be acceptable if the bond and compressive strength values are equal to or higher than the portland cement-lime mix. The air-content of the masonry cement shall be limited to 12 percent maximum.

2.3.2 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used

subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494/C 494M, Type C.

2.3.3 Colored Mortar

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color as indicated on drawings. Quantity of pigment to cementitious content of the masonry cement shall not exceed 5 by weight; carbon black shall not exceed 1 percent by weight. Quantity of pigment to cementitious content of cement-lime mix shall not exceed 10 percent by weight, carbon black no more than 2 percent by weight. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.4 JOINT REINFORCEMENT

Joint reinforcement shall be of steel wire conforming to ASTM A 82. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153/A 153M, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 11 square mm (0.017 square inches. Minimum mortar cover shall be 16 mm. Joint reinforcement shall be placed in all horizontal mortar joints to receive anchor ties. Reinforcement shall be continuous with lap splices between ties.

2.5 WOOD FRAMING

Wood framing shall consist of studs, top and bottom sills, blocking, horizontal bridging, and other members and other accessories. Framing used in the exterior masonry veneer wall system shall be as specified in SECTION 06100 ROUGH CARPENTRY and as indicated on drawings.

2.6 CAVITY INSULATION

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.6.1 Rigid Board-Type Insulation

Insulation in cavities behind veneer shall be rigid board-type insulation. Rigid board-type insulation shall be either polystyrene conforming to ASTM C 578, Type II, or polyurethane conforming to ASTM C 591. Insulation thickness shall be 38 mm. Total minimum R-value of 38 mm of insulation shall be 6.

2.7 EXTERIOR SHEATHING

Sheathing on the exterior side of the wood framing shall be exterior grade plywood as specified in 06100 ROUGH CARPENTRY.

2.8 MOISTURE PROTECTION

2.8.1 Air and Moisture Barrier

2.8.1.1 Building Wrap

Tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125 grams per square meter per 24 hours in accordance with ASTM E 96, Desiccant Method at 63 degrees C, or with a moisture vapor transmission rate of 670 grams per square meter per 24 hours in accordance with ASTM E 96, Water Method at 23 degrees C.

2.8.1.2 Fluid Applied Membrane

Fluid applied membrane system including joint filler and joint reinforcing mesh fabric with a water vapor transmission rate not greater than 350 ng/Pa s m^2) (6.0 perms) per 24 hours in accordance with ASTM E 96, Water Method at 23 degrees C. Minimum dry tensile strength per ASTM D 882 shall be 20 kN/m. Surface burning characteristics per ASTM E 84 shall meet requirements for NFPA Class A and IBC Class 1 building material.

2.8.2 Staples

Staples for attaching building wrap type moisture barrier to the exterior sheathing shall be the type and size approved by the manufacturer and best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

2.8.3 Joint Tape

Tape for sealing joints in building wrap shall be laminated tape with pressure sensitive adhesive as recommended by the manufacturer.

2.9 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the wood framing, shall be as shown. Anchor locations not depicted shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the wood framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 32 mm from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 5 mm diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2. The veneer anchor shall have a minimum capacity of 900 newtons. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall be not less than 350 kilo newtons per meter (2000 pounds per inch) (or a deflection of 2.85 mm per kilo Newton (0.05 inches per 100 pounds) of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1.6 mm.

2.10 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

2.10.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the wood framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

2.10.2 Welding

Welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI SG-971-Spec. Welders shall be qualified in accordance with AWS D1.3. All welds shall be cleaned and touched-up with zinc-rich paint.

2.10.3 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the wood framing members shall be as required by design to provide the needed pullout load capacity, but not less than No. 12. Each screw shall have a minimum ultimate pullout capacity of 540 pounds. Screws shall be shown on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 16 mm.

2.10.4 Exterior Sheathing Screws

Screws for attachment of plywood sheathing to wood framing shall conform to ANSI B18.6.1 and the requirements of the International Building Code.

2.11 SYNTHETIC RUBBER WASHERS

Synthetic rubber washers for placement between veneer anchors and the air and moisture barrier on the outside face of the exterior sheathing shall conform to ASTM D 1330, Grade I.

2.12 FLASHING

Flashing shall be as specified in Section 07600 FLASHING AND SHEET METAL and this section. Provide the following type, except that flashing indicated to terminate in reglets shall be metal or coated-metal flashing and that the material shall be one which is not adversely affected by dampproofing material. Through wall flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

a. Copper or Stainless Steel Flashing: Copper, ASTM B 370, minimum 450 g (16 ounce) weight; stainless steel, ASTM A 167, Type 301, 302, 304, or 316, 4 mm thick, No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of

dimples and transverse corrugations.

2.13 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to ASTM A 36/A 36M. Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123/A 123M.

2.14 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07920 JOINT SEALANTS. All sealants used at brick veneer expansion joints shall have a color matching the brick color.

2.15 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum or plastic sized to form a full height opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects. Ventilators shall be sized to match modular construction with a standard 10 mm mortar joint.

2.16 CAVITY DRAINAGE FABRIC

Manufacturer's standard woven fabric product designed to ensure drainage from the cavity in brick veneer construction. Thickness to match cavity depth with minimum height of 200 mm. Fabricated of high density polyethylene (HDPE) or polyester mesh with at least 85 percent open weave construction. Material shall be non-reactive with all adjacent materials found in air cavity. Top edge of material shall have a stepped or saw tooth configuration. Design of fabric shall capture and suspend fallen mortar to maintain a path for air and water movement through and out of the cavity.

2.17 LIQUID WATER REPELLANT COATING

Water repellant shall be a clear penetrating coating that reacts with masonry surfaces to form a chemical water repellent bond; water based alkylalkoxysilane (minimum 20 percent by weight); applied in the field by an applicator approved in writing by the material manufacturer in accordance with the manufacturer's directions. Coating shall have a water absorption rate of not more than 0.53 percent in 48 hours when tested in accordance with ASTM C642-82. Coating shall not inhibit adhesion of sealants specified in SECTION 07920 JOINT SEALING.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door, window and louver frames and other special framing shall be built and anchored into the wall system as indicated. The Contractor shall submit calculations as specified in the Submittals paragraph.

3.2 WOOD STUD WALL FRAMING

Stud wall framing shall be complete and all structural frame and roof members shall be securely anchored to the exterior wall system prior to beginning brick veneer installation. Anchoring of sill plates shall be complete. All details necessary for anchorage of the stud wall system to the building structural systems shall be as shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced as indicated on the drawings. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Provide the number of jamb studs indicated at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 3000 mm in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 1200 mm where possible. Shelf angle segments shall not be connected together but instead shall be installed with 6 mm wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC 316.

3.4 INSULATION

The actual installed thickness of insulation shall provide thermal R values as indicated. Insulation thickness shall be as shown on the approved drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Insulation shall be installed between wall framing members. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

3.5 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the framing system and attached as indicated for shear wall construction. Edges and ends of sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the air and moisture barrier. Holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

3.6 MOISTURE PROTECTION

3.6.1 Building Wrap

Air and moisture barrier shall be installed on the outer face of the exterior sheathing. Building wrap type barrier shall be installed horizontally and shingled with each sheet lapped not less than 150 mm over the sheet below. Vertical end joints shall be lapped not less than 150 mm and shall be staggered. Attachment of the barrier shall be with staples spaced not greater than 400 mm on center or as required by the manufacturer. Provide tape or adhesive seal between end laps.

3.6.2 Fluid Applied Membrane

Air and moisture barrier shall be installed on the outer face of the exterior sheathing. Fluid applied membrane barrier shall be installed over manufacturer's standard joint and seam reinforcing tape. All sheathing joints, seams and edges shall be taped prior to application.

3.7 VENEER ANCHORS

Veneer anchors shall be attached with screws through the sheathing to the wood studs or other support members at the locations shown. Anchor design shall incorporate a method for retention of cavity insulation. The method of connecting the veneer anchors shall be approved by the Contracting Officer. Veneer anchors shall be installed with the outermost wires lying between 16 mm from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the moisture barrier. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to framing. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each 0.2 square meters of wall and shall be attached to studs and other supports with a maximum spacing of 400 mm on center horizontally and vertically. At all wall openings install additional ties at no greater than 1000 mm on center within 300 mm or the opening. Pintle-eye anchors shall not be used. Dovetail slots shall be installed as specified in the Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.8 FLASHING

Continuous through wall flashing shall be provided at the bottom of the wall cavity just above grade. Through wall flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and as indicated on the drawings. Flashing shall be as detailed and as specified in Section 07600 FLASHING AND SHEET METAL and this section. Flashing shall be lapped a minimum of 150 mm at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Vertical leg of flashing shall extend at least 200 mm up sheathing surface. Provide end dams as detailed at flashing locations over doors, windows and openings and other areas where through wall flashing is discontinuous. Flashing shall be lapped under the air and moisture barrier a minimum of 150 mm and securely attached to the sheathing. If fluid applied membrane barrier is utilized, provide fabric flashing transition from membrane to top of through wall flashing. Through wall flashing shall extend through the exterior face of

the masonry veneer and shall be turned down and returned to form a hemmed, drip edge. Flashing shall be sloped across cavity to ensure drainage to the exterior. Weeps shall be placed immediately above the flashing. Cavity drainage fabric shall be placed immediately above the flashing.

3.9 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of an unobstructed air space shall be provided between the cavity insulation and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, air and moisture barrier, insulation, veneer anchors and flashing have been installed on the wood framing system. Extreme care shall be taken to avoid damage to the air and moisture barrier and flashing during construction of the masonry veneer. Any portion of the air and moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Longitudinal reinforcement consisting of at least one continuous galvanized steel wire shall be placed in the veneer wythe. The minimum wire size shall be 9 gauge. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 13 mm into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

3.9.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

3.9.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 50 degrees C when laid. Masonry erected when the ambient air temperature is more than 37 degrees C in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

3.9.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 4 degrees C when laid. When the ambient air temperature is 0 degrees C or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 0 degrees C for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to

implementation. No units shall be laid on a surface having a film of frost or water.

3.9.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

Variation From Plumb	
In adjacent units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variation From Level Or Grades	
In 3 m	3 mm
In 6 m	6 mm
In 12 m or more	13 mm

Variation From Linear Building Lines	
In 6 m	13 mm
In 12 m or more	19 mm

Variation From Cross Sectional Dimensions Of Walls	
Plus	13 mm
Minus	6 mm

3.9.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

3.9.6 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

3.9.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

3.9.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 6 mm nor more than 13 mm wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

3.9.9 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.9.10 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm.

3.9.11 Joint Reinforcement

Unless otherwise shown, joint reinforcement shall be spaced at 400 mm on center vertically. Joint reinforcement shall be placed in the same masonry course as veneer anchors with anchors designed to provide a mechanical

connection to the reinforcement wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 150 mm. Joint reinforcement must be discontinuous at all expansion joints. The minimum cover for joint reinforcement is 16 mm.

3.9.12 Veneer Joints

Brick expansion joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Vertical joints shall not be spaced greater than 9000 mm apart in the field of the wall. Provide vertical joints at all inside corners. At outside building corners provide a joint on each side of the corner spaced as indicated. Locate joints symmetrically across the face of the building. Joints shall be placed centered between adjacent openings where possible. Avoid locating joints where they will be interrupted by door, window or louver openings. Joints shall be constructed from foundation to top of wall without deviation from vertical. Horizontal joints shall be provided at shelf angles installed to limit the bearing height of brick veneer. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07920 JOINT SEALANTS. Horizontal reinforcement shall not extend through the joints.

3.9.13 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 600 mm. Weep holes shall be placed in head joints just above the flashing. Weep holes shall be formed by using premanufactured weep hole ventilators. Weep holes shall be kept free of mortar and other obstructions.

3.9.14 Head Joint Vents

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes. Utilize weep hole ventilators to provide insect barrier.

3.9.15 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Toothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 12 00 mm down on each side of the wall and shall be held securely in place.

3.9.16 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall

panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

3.9.16.1 Brick

The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations.

3.10 BOND BREAKS

At locations where brick veneer is in contact with a dissimilar material, such as pre-cast concrete, a bond break shall be installed. Bond break shall be a layer of No. 15 asphalt felt or sheet metal flashing located between the dissimilar material and the adjacent mortar joint.

3.11 APPLICATION OF LIQUID WATER REPELLANT

Liquid water repellant is required on all masonry surfaces exposed to the environment (including entrance vestibules). Apply repellant after completion of adjoining elastomeric sealant work and initial cleaning of brick and masonry units. Apply material in accordance with manufacturer's printed instructions. Mask adjacent areas to avoid contamination of glass, metals and other adjacent surfaces. After 21 days, spray water on coated surfaces and identify areas that are absorptive. Allow wall to dry and recoat any absorptive surfaces.

3.12 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material. Protect masonry surfaces when painting or coating of adjacent surfaces is in progress.

3.13 TEST REPORTS

3.13.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.13.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 13.8 MPa at 28 days.

3.13.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Do not begin installation of brick veneer without approved test results. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Rating of units tested shall be "not effloresced" or brick will be subject to rejection. Mortar shall be tested consistent with the procedures described in this section.

-- End of Section --

SECTION 05090

WELDING, STRUCTURAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec	(1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(2001) Recommended Practice

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(2001) Standard Welding Terms and Definitions
AWS D1.1	(2000) Structural Welding Code - Steel
AWS Z49.1	(1999) Safety in Welding and Cutting and Allied Processes

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA 353	(2000) Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications

1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC ASD Spec unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise

approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

1.3.1 Pre-erection Conference

A pre-erection conference shall be held, prior to the start of the field welding, to bring all affected parties together and to gain a mutually clear understanding of the project and the Welding Procedure Specifications (WPS) (which the Contractor shall develop and submit for all welding, including welding done using prequalified procedures). Attendees shall include all Contractor's welding production and inspection personnel and appropriate Government personnel. Items for discussion could include: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and ultrasonic; welding schedule; fabrication of mock-up model; and other items deemed necessary by the attendees.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Welding Procedure Qualifications; G.
Welder, Welding Operator, and Tacker Qualification; G
Inspector Qualification; G.
Previous Qualifications; G
Prequalified Procedures; G

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

SD-06 Test Reports

Quality Control; G

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures,

each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1 will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1, the procedure specification shall be revised and requalified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract

shall be qualified in accordance with the applicable requirements of AWS D1.1 and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.6.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept on file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.

d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

1.7 INSPECTOR QUALIFICATION

Inspector qualifications shall be in accordance with AWS D1.1. The inspector in responsible charge shall have an AWS CWI QC1 certification. Nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT RP SNT-TC-1A for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT RP SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.9 SAFETY

Safety precautions during welding shall conform to AWS Z49.1.

PART 2 PRODUCTS

2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC ASD Spec. When AWS D1.1 and the AISC ASD Spec specification conflict, the requirements of AWS D1.1 shall govern.

3.1.2 Identification

Welds shall be identified in one of the following ways:

a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.

b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 1 meter intervals. Identification with die stamps or electric etchers shall not be allowed.

3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform nondestructive testing (MT and UT) on all moment frame connections in accordance with the frequency and methods stated in Table 6-3 of FEMA 353 and the contract drawings. For welded connections for beams, other than moment connections, the Contractor shall perform visual and dye penetrant inspection to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1, except that in radiographic inspection only film types designated as "fine grain," or "extra fine," shall be employed. The inspector in responsible charge shall write a statement of responsibility to the Contracting Officer for each building. They shall state that all welds have been inspected in accordance to AWS D1.1 and the contract drawings, and will indicate any locations of defective work.

3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1 and the contract drawings. Nondestructive testing on welded shear connections for beams, other than moment connections, shall be by visual inspection and dye penetrant methods. The minimum extent of nondestructive testing for welded shear connections shall be random 10 percent of welds or joints, as indicated on the drawings. Nondestructive testing shall be performed on all moment connections and full penetrations welds. All field welds shall be visually inspected in accordance with AWS D1.1.

3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification

requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

3.3.2 Destructive Tests

When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders or welding operators, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1 and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to ensure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present. Immediately recertify, or replace with qualified welders, those welders that have passed qualification tests but are producing unsatisfactory welding.

-- End of Section --

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SECTION 05091

ULTRASONIC INSPECTION OF WELDMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(2001)Recommended Practice SNT-TC-1A
ASNT Q&A Bk C	(1994) Question and Answer Book C: Ultrasonic Testing Method; Levels I, II, III (Supplement to RP SNT-TC-1A)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA 353	(2000) Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications

1.2 DEFINITIONS

1.2.1 A Scan

Method of data presentation on a cathode ray tube using rectangular coordinates in which a horizontal base line indicates elapsed time when reading from left to right. A vertical deflection in the base line indicates reflect signal amplitude.

1.2.2 Acoustically Similar Material

Material the same as that to be inspected; or another material proven to have acoustical velocity within plus or minus 3 percent and an attenuation within plus or minus 0.009843 dB/mm of the inspected material for the inspection frequency and wave mode, using the same mode as that to be used for inspection.

1.2.3 Amplitude

When referring to an indication in A scan presentation, amplitude is the vertical height of the indication measured from peak-to-peak for radio frequency indications and trace-to-peak for video indications.

1.2.4 Attenuation

Dissipation or loss of energy as ultrasonic vibrations travel through the material. Attenuation is caused almost entirely by scattering of the ultrasonic vibrations generated by the search unit.

1.2.5 Attenuation-Correction Controls

Circuitry to provide a continuous increase in amplification with respect to time. This circuitry compensates for the reduction in sensitivity with depth as a result of sound beam divergence and its attenuation in material.

1.2.6 Back Reflection or End Reflection

Reflection from the opposite side, end, or boundary of the material into which the ultrasonic energy was introduced.

1.2.7 Calibrated Gain Control (Attenuator)

Circuitry with which gain can be reduced finite amounts by switching electrical signal attenuation into the circuit.

1.2.8 Calibration

Process of comparing an instrument or device with a standard to determine accuracy or produce a scale.

1.2.9 Cathode Ray Tube (CRT)

An electron tube in which a controlled beam of electrons from the cathode is used to produce an image on a fluorescent screen at the end of the tube.

1.2.10 Couplant

Any material, usually a liquid or semiliquid, used between the search unit and the inspection surface to exclude air and to convey the ultrasonic vibrations between the search unit and the material being inspected.

1.2.11 Damping Control

Control that varies the duration of transducer ringing.

1.2.12 Decibel (dB)

Units for the logarithmic expression of the ratio of power levels. Power levels can be functions of voltage, current, or impedance, for example. Decibel units having no values of their own are only significant when a reference is stated, as 10 dB above one reference level or 6 dB below another reference level.

1.2.13 Delay Control

Means of delaying the pattern obtained on the CRT.

1.2.14 Discontinuity

Anything within a material that will cause a detectable interruption in an ultrasonic beam.

1.2.15 Distance-Amplitude Correction Curve

Curve showing the relationship between signal amplitude and equal-sized reflecting surfaces at various distances from the transducer. Reference standards are used to obtain such curves.

1.2.16 Dynamic Range

Ratio of maximum to minimum size of reflective areas that can be adequately distinguished on the CRT at a constant gain setting.

1.2.17 Effective Depth of Penetration

Maximum depth at which the sensitivity is satisfactory for the quality of test desired.

1.2.18 Examination

Within the context of this specification, examination is equivalent to the word "inspection."

1.2.19 Gain Control

Circuitry designed into the ultrasonic system to vary reflection amplitude. This control is usually calibrated in decibels. It is also called the sensitivity control.

1.2.20 Gross

Background displacement of the trace on the CRT from the established baseline due to the gain setting, the characteristics of the test equipment, or the material under examination.

1.2.21 Hertz

One complete set of recurrent values of a periodic quantity comprises a cycle. In other words, any one set of periodic variations starting at one condition and returning once to the same condition is a cycle.

1.2.22 Immersion Techniques

Test methods in which the part to be tested and the search units are immersed in water or other suitable liquid couplant. A mechanical device is used to firmly hold and direct the wave angle of the search unit. The search unit does not contact the item being inspected.

1.2.23 Indication

Visual presentation on the cathode ray screen resulting from a sound beam reflection from a boundary surface or discontinuity.

1.2.24 Initial Pulse Indication

Usually called the "initial pulse". A signal on the CRT screen marking the instant at which a voltage impulse is applied to the transmitting crystal. Its rising edge is frequently invisible due to the time lag in the probe shoe and the consequent necessity to ensure coincidence between the time base zero and the instant at which the transmitter pulse actually enters the material under test.

1.2.25 Linearity

Property of an instrument revealed by a linear change in reflected signal or displacement. The vertical linearity is determined by plotting the change in ratios of signal amplitude from two adjacent reflections from an area of known size. The horizontal linearity is determined by plotting the distance the signal is displaced along the sweep against the change in material thickness or by noting the spacing of multiple back reflections.

1.2.26 Longitudinal or Compressional Waves

Simple compression-rare-fraction waves in which particle motion within a material is linear and in the direction of wave propagation. Also called straight beams, or compressional or normal waves.

1.2.27 Longitudinal Wave Inspection

Ultrasonic technique, normally using straight beam methods, in which longitudinal waves are the dominant form.

1.2.28 Mid-Screen Reflection

Reflection whose amplitude is equal to one-half the useable screen height on the CRT.

1.2.29 Megahertz (MHz)

One million hertz per second frequency.

1.2.30 NDT Level I

An NDT Level I individual should be qualified to properly perform specific calibrations, specific NDT, and specific evaluations for acceptance or rejection determinations according to written instructions, and to record results.

1.2.31 NDT Level II

An NDT Level II individual should be qualified to set up and calibrate

equipment and to interpret and evaluate results with respect to applicable codes, standards, and specifications.

1.2.32 NDT Level III

An NDT Level III individual should be capable of establishing techniques and procedures; interpreting codes, standards, specifications, and procedures; and designating the particular NDT methods, techniques, and procedures to be used.

1.2.33 Node

Distance a shear wave travels in a straight line from the inspection surface before being reflected by the opposite surface.

1.2.34 Pulse Repetition Rate

Number of spaced pulses of sound per second sent into the material being inspected.

1.2.35 Range Control

Means of expanding the pattern obtained on the CRT so that any portion of the total distance being tested can be presented.

1.2.36 Reference Reflector

Standard reflector 1.52 mm () diameter reference hole in the IIW reference block. Other approved blocks may have a different diameter reflector.

1.2.37 Reflector

Boundary, consisting of an opposite side, crack, or separation, or a distinct change in material such as slag or porosity that reflects the ultrasonic energy the same as a mirror reflects light.

1.2.38 Refracted Waves

Waves that have undergone change of velocity and direction by passing from one material to another material with different acoustical properties. Refraction will occur wherever the angle of the incident wave to the interface is other than perpendicular.

1.2.39 Rejectable Discontinuity (Defect)

Reflector large enough to produce a signal (decibel rating) that exceeds the reject/repair line.

1.2.40 Resolution

Ability to clearly distinguish signals obtained from two reflective surfaces with a minimum separation distance. Near-surface resolution is the ability to clearly distinguish a signal from a reflector at a minimum distance under the contact or near surface without interference from the

initial pulse signal. Far-surface resolution is the ability to clearly distinguish signals from reflectors displaced at minimum distances from the far or back surface when the sound beam is normal to that back surface.

1.2.41 Ringing

Excitation in a transducer due to the application of a short pulse of high voltage.

1.2.42 Scanning

Procedure of moving the search unit or units along a test surface to obtain complete inspection of the entire volume of a material being inspected. Preliminary scanning refers to a somewhat common practice of rapidly traversing a weld ultrasonically with a higher instrument gain or sensitivity level than will be used for the evaluation. It gives the operator an estimate of the welding quality and also makes all defects more prominent and less likely to be missed.

1.2.43 Search Unit

Device containing a piezoelectric material used for introducing vibrations into a material to be inspected or for receiving the vibrations reflected from the material. The active element of the search unit is defined as the effective transmitting area. Search units are also called transducers or probes. They may be single or dual and contain one or two piezoelectric elements, respectively, for transmission and reception. The single search unit is sometimes enclosed in a transducer wheel or search unit wheel. The search unit may be manually handled and placed in direct contact with the material to be inspected or may be held in a fixture for immersion techniques.

1.2.44 Sensitivity

Measure of the ultrasonic equipment's ability to detect discontinuities. Quantitatively, it is the level of amplification of the receiver circuit in the ultrasonic instrument necessary to produce the required indication on the scope from the reference hole in the reference block. Also see "Standard Reference Level."

1.2.45 Shear Waves

Waves in which the particles within the material vibrate perpendicularly to the direction in which the wave travels or propagates. Also called transverse waves.

1.2.46 Shear Wave Inspection

Inspection technique using shear waves in a material. The search unit is placed at an angle to the contact surface of the material so the resultant refracted sound is a shear wave at an angle to the normal.

1.2.47 Standard Reference Level

Mid-screen height reflection when beaming at the 1.52 mm hole in the primary reference block or the reference hole in the secondary standard.

1.2.48 Surface Waves

Waves that propagate along the surface of the material and penetrate it to only about 1/2-wavelength. Also known as Rayleigh waves.

1.2.49 Test Frequency

Operating frequency in hertz per second of the search unit during period of activation. Frequency is usually expressed in megacycles per second or megahertz. The latter term has been adopted for international use and is preferred.

1.2.50 Video Form

Type of signal presentation on a CRT in which only the upper half of the signal appears.

1.3 GENERAL REQUIREMENTS

The procedures, methods, standards, and description of equipment specified herein shall be used for inspection of weldments for moment frame connections and all complete penetration welds. Nondestructive testing shall be made to detect the following defects:

a. Cracks or crack-like faults.

b. Root defects, including lack of penetration and fusion.

c. Lack of fusion between passes on the sidewall.

d. Porosity or inclusions and excessive undercutting.

Frequency of testing and testing method requirements for moment connections shall be in conformance with Table 6-3 of FEMA 353 and the contract drawings.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Ultrasonic Inspection; G.

Procedures and Methods. The pulse echo contact method with an A scan presentation shall be used for the ultrasonic inspection of

welded joints, except that immersion techniques may be used for some applications when approved by the Contracting Officer. The Contractor shall provide a standard reference block and working standards as described in paragraph REFERENCE STANDARDS FOR EQUIPMENT, QUALIFICATIONS, AND CALIBRATION. The procedures to be used for personnel and equipment qualification, equipment calibration, and inspection, shall be submitted to the Contracting Officer at least 30 days prior to their intended use. Approval by the Government will in no way affect the obligation of the Contractor to employ qualified personnel, equipment, and procedures, and to perform the inspection as specified. The procedure description shall include the following:

a. Couplant.

b. Search unit characteristics including angle, size, shape, nominal frequency, type designation.

c. Method and type of wave.

d. Equipment and accessories including manufacturer, model number, date of manufacture, last date of calibration, and the manufacturer's electrical, physical, and performance specifications.

e. Decibel (dB) compensation system for distance-amplitude correction.

Reports containing the following information:

a. Identification and Location of Inspected Item: Name and place of the inspected item, the person performing the inspection, and the date of inspection.

b. Detail of Inspections: Details of methods, types of waves used, search units, frequencies, inspection equipment identification, and calibration data with enough information to permit duplication of the inspection at a later date.

c. Response in Calibration: The response from the DSC or SC block used in calibration and for acceptance/rejection in terms of the response from the 1.524 mm reference hole in the standard IIW block (primary standard).

d. Identification of Unacceptable Areas: Locations, dimensions, types, and area of unacceptable defects and discontinuities giving reflections over 50 percent of the reject/repair line. These may be noted on a sketch or marked-up drawing.

e. Record of Repair Areas: A record of repaired areas shall be furnished as well as test results for the repaired areas.

1.5 WAVE TYPES

The types of waves and the conditions under which they shall be used are specified below:

1.5.1 Shear Waves

Unless conditions prohibit, shear waves shall be used. A longitudinal wave procedure may be used instead, if approved by the Contracting Officer. Refracted waves between 40 degrees and 70 degrees shall be used except where different angles are indicated in approved procedures, such as for materials less than 13 mm thick, for materials with sound velocities greater than in steel, when the weldments are not readily accessible, or when existing backing rings or backing strips are not removed. For inspection of weldments containing backing rings or backing strips, the instrument shall be adjusted and the refracted angles shall be selected in a way to separate the weldment and the backing ring reflections. The search unit angle and the resulting shear wave angle in the material to be inspected shall be established by the Contractor for each application and this information shall be included in the procedure submitted for approval.

1.5.2 Longitudinal Waves

When conditions prohibit the use of shear waves, longitudinal waves may be used. The procedure shall be specially developed to suit the application and shall have the prior approval of the Contracting Officer.

1.6 CHANGES IN PROCEDURE

Should application of an approved procedure not provide for good resolution or adequate ultrasonic penetration in the items to be inspected (see paragraph EQUIPMENT QUALIFICATION REQUIREMENTS), changes in procedure or equipment such as frequency, pulse repetition rate, angle of search unit, couplant, or oscilloscope shall be made by the Contractor. Adequacy of the new procedure shall be demonstrated to the Contracting Officer. The Government reserves the right to require a change in test equipment during these tests if any of the following test system characteristics fall below the levels listed in paragraph EQUIPMENT QUALIFICATION REQUIREMENTS: sensitivity, amplitude and distance linearity, signal-to-noise ratio, entry and back surface resolution and penetration.

1.7 ULTRASONIC EQUIPMENT

The ultrasonic equipment shall conform to the requirements listed in AWS D1.1 Section Inspection, subsection Ultrasonic Equipment, with the following exceptions:

a. The ultrasonic test instruments shall be able to generate, receive, and to present pulses in the frequency range from 1 to 10 megahertz (MHz).

b. The horizontal linearity of the ultrasonic instrument shall be measured in accordance with paragraph EQUIPMENT QUALIFICATION REQUIREMENTS.

c. In addition to the resolution test specified in AWS D1.1,

subsection Ultrasonic Equipment, both near- and far-surface resolution tests shall be conducted in accordance with the tests specified for these characteristics in the paragraph EQUIPMENT QUALIFICATION REQUIREMENTS.

1.8 PERSONNEL QUALIFICATION AND REQUIREMENTS

1.8.1 Personnel Qualification

The three levels of responsibility associated with ultrasonic inspection are defined in ASNT RP SNT-TC-1A. For qualification to perform ultrasonic inspection, personnel shall be certified under ASNT RP SNT-TC-1A and ASNT Q&A Bk C within a period of 1 year before the date of contract. Other qualification or certification may be accepted at the Contracting Officer's discretion. Personnel with only an operator or inspector trainee certification will not be considered qualified to pass judgment on the acceptability of inspected items, but may work under the direct supervision of a qualified ultrasonic inspector. Qualified ultrasonic inspectors shall be able to judge the acceptability of the item in accordance with paragraph ACCEPTANCE/REJECTION LIMITS.

1.8.2 Examinations

If the Contracting Officer doubts an individual's ability as an operator, inspector, or supervisor, the individual shall be recertified in accordance with ASNT RP SNT-TC-1A. At the option of the Government, the Contracting Officer may participate in administering the examination and in evaluating the results.

1.9 REFERENCE STANDARDS FOR EQUIPMENT, QUALIFICATIONS, AND CALIBRATION

Reference standards shall be used to calibrate the inspection equipment, test its operating condition, and record the sensitivity or response of the equipment during the inspection in accordance with paragraph EQUIPMENT QUALIFICATION REQUIREMENTS. The standards shall comprise a standard reference block and reference specimens as noted below.

1.9.1 Standard Reference Block

The standard reference block or primary standard shall be provided by the Contractor and shall consist of the IIW block in AWS D1.1, Section Inspection, subsection Reference Standards. The standard reference block also shall be used in any reinspection on the same basis as the original inspection, even though the reinspection is to be performed by other ultrasonic instruments and accessories.

1.9.2 Working Standards

The Contractor may use other recognized working standards detailed with the IIW block in AWS D1.1 such as the Sensitivity Calibration (SC) block. However, such blocks shall be referenced to the IIW block as noted in paragraph SENSITIVITY CALIBRATION OF LONGITUDINAL AND ANGLE WAVE SYSTEMS. Details of their use shall be included in the procedure description submitted to the Contracting Officer. These blocks are the secondary

standards. They shall be of acoustically similar material to the welds to be inspected. The secondary standards shall be suited for the applicable tests specified in paragraph EQUIPMENT QUALIFICATION REQUIREMENTS and shall be used as follows, except where the IIW block is specifically required:

a. To assure adequate penetration of the base material.

b. To provide a secondary field standard.

c. To calibrate the equipment and establish the standard reference level.

1.9.3 Resolution Test Block

The Contractor shall furnish a resolution test block in accordance with the details shown in AWS D1.1 Section Inspection, subsection Ultrasonic Equipment.

1.10 EQUIPMENT QUALIFICATION REQUIREMENTS

The ultrasonic instrument and accessories shall be evaluated on their arrival at the jobsite, immediately prior to the start of inspection. They shall be evaluated using the Contractor's furnished primary standard and shall meet or exceed the requirements listed in paragraphs below. Equipment that does not meet these requirements shall not be used in the inspection.

1.10.1 Requalifications

The equipment shall be requalified after normal use at intervals not to exceed 40 hours, except as noted. The equipment also shall be requalified immediately after maintenance or repair or when the Contracting Officer considers its operation questionable.

1.10.2 Longitudinal Wave System

1.10.2.1 Vertical Amplitude Linearity

Two adjacent reflections of different amplitudes obtained through the thickness of the primary or secondary standard shall vary in the same proportion as the amplitude of the first reflection is increased in discrete 2-dB increments between 20 percent and 80 percent to full screen height. For each gain setting, the amplitude of each reflection shall vary by the same factor, within plus or minus 5 percent. Requalification is required monthly or as otherwise stated.

1.10.2.2 Horizontal Linearity

The first three multiple reflections obtained through the thickness of the primary or secondary standard shall be equally spaced, within plus or minus 5 percent, when spread over 90 percent of the sweep length. Requalification is required monthly or as otherwise stated.

1.10.2.3 Near-Surface Resolution

Excessive ringing that appears on the CRT to the right of the sound entry point shall not exceed a 13 mm equivalent distance in steel with the search unit placed on the 100 mm edge of the IIW (primary) block and positioned for maximum amplitude reflection from the 1.524 mm reference hole of the primary standard. The reference reflector shall be set to mid-screen and the gain shall be increased 20 dB. The reference hole located at least 13 mm from one edge of the AW DSC or SC secondary standard shall be used similarly. Acceptability will be on the same basis as in the primary standard.

1.10.2.4 Far-Surface Resolution

This property of the equipment shall be verified by the method detailed in AWS D1.1, Section Inspection, subsection Calibration of the Ultrasonic Unit with the IIW or Other Approved Calibration Blocks. In addition, the trailing edge of the third reflection shall return to the sweep line and be clearly discernible.

1.10.3 Angle Wave System

1.10.3.1 Vertical (Amplitude) Linearity

Two adjacent multiple reflections from the 1.524 mm reference hole in the primary standard shall vary in the same proportion as the amplitude of the first reflection in discrete 2-dB increments between 20 percent and 80 percent of full screen height. For each gain setting, the amplitude of each adjacent reflection shall vary within plus or minus 5 percent. For testing with the AWS SC or AWS DSC secondary standard, the same criteria shall apply. For the SC block, the transducer shall be placed on the longitudinal surface contiguous with the sound entry point lines, whereas the 100 mm longitudinal surface of the DSC block shall be used for the same purpose. Requalification is required monthly, or as otherwise stated.

1.10.3.2 Horizontal Linearity (Angle Wave}

The first three multiple echoes, obtained from the 1.524 mm inch reference hole of the primary standard or from the reference hole in a secondary standard with the transducer positioned at a minimum of 25 mm sound path distance, shall be equally spaced plus or minus 5 percent when spread over 90 percent of the sweep length. The gain shall be adjusted to give a mid-screen height first reflection. Requalification is required monthly or as otherwise stated.

1.10.3.3 Near-Surface Resolution (Angle Wave)

The search unit shall be positioned for maximum amplitude using the primary or secondary standard as in the horizontal linearity test. The gain shall be adjusted to give a mid-screen height first reflection and then shall be increased 20 dB. Excessive ringing that appears on the CRT to the right of the sound entry point shall not exceed 13 mm equivalent distance in steel.

1.10.3.4 Far-Surface Resolution (Angle Wave)

The equipment shall delineate the three resolution holes in the resolution block appropriate for the angle of the transducer to be used in the inspection.

1.10.3.5 Signal-to-Noise Ratio

With the search unit located as in the horizontal linearity test, the gain shall be set to obtain an 80 percent full screen height first reflection. The reference reflection-to-noise-amplitude ratio shall not be less than 10 to 1.

1.10.3.6 Exit Point

The search unit shall be placed on the graduated scale on the 300 mm edge of the primary standard and the ultrasound shall be beamed toward the curved edge of the block. The gain shall be set for a mid-screen first reflection. The search unit shall be moved back and forth until the first reflection is maximized. The index line on the side of the search unit shall be within 1.6 mm of the mid-point of the graduated scale in either direction. Requalification is required after 40 hours or as otherwise stated.

1.10.3.7 Transducer Angle

The established exit point of the probe shall be set over the applicable angle index line scribed on the 200 mm or 300 mm edge, as appropriate, of the primary standard. The gain shall be set to obtain a mid-screen first reflection from the 50 mm plexiglass-lined hole for search units up to 70 percent with the search unit placed on the 200 mm edge. Search units of large angles that have been approved specifically by the Contracting Officer shall be tested from the 300 mm edge using the 1.524 mm reference hole. The search unit shall be moved back and forth to maximize the first reflection. When the material to be inspected is not acoustically similar to the primary standard, the inspection angle shall be within plus or minus 2 degrees of the angle specified in the approved procedure. Requalification is required after 40 hours or as otherwise stated.

1.11 SENSITIVITY CALIBRATION OF LONGITUDINAL AND ANGLE WAVE SYSTEMS

Sensitivity calibration shall be done immediately after a change of operators and at least every 30 minutes thereafter as testing proceeds. Recalibration will be required after any power interruption, including a change of source, when the equipment is suspected of being in error, or after relocation of the jobsite. The 30-minute and relocation calibrations may coincide. The instrument shall be allowed to warm up before calibration is attempted. The instrument range and delay controls shall be adjusted to display signals from the reference hole in the primary (IIW block) or secondary standard (DSC or SC block or both) on the viewing screen for the range of distances to be inspected.

1.11.1 Calibration Procedure

The test instrument shall be calibrated as described below.

1.11.1.1 Longitudinal Wave

In calibrating with the primary standard, the transducer shall be positioned on the 100 mm edge for maximum reflection from the 1.524 mm reference hole. The gain shall be adjusted so that the first reflection is at 50 percent full scale. The top of that indication shall be marked on the CRT with a wax pencil or by other means. This establishes the standard reference level. A point at 80 percent of the standard reference level shall be calculated and marked. This locates the reject/repair line. If a secondary standard is to be used in the inspection, the reject/repair line shall be established similarly. For the DSC block, the transducer shall be positioned on the 100 mm long surface and with the SC degrees sound entry point lines. Adjustment for loss of signal due to distance shall be compensated for as noted above.

1.11.1.2 Angle Wave

In calibrating with either the primary or secondary standard, the transducer shall be positioned on the same surfaces as in the case of the longitudinal wave system but over the sound entry point lines appropriate for the angle of the transducer to be used in the inspection. The gain shall be adjusted to give a first reflection that is 50 percent of full-scale response. The top of that indication shall be marked with a wax pencil or by other means. This establishes the standard reference level. A point at 80 percent of the standard reference level shall be calculated and marked. This locates the reject/repair line. Loss of signal shall be compensated as noted.

1.11.2 Calibration of the Secondary Standards

After adjusting the first reflection from the reference hole in the secondary standard to 50 percent full-scale response for a shear or longitudinal wave inspection, a maximized reflection from the 1.524 mm reference hole in the primary standard shall be obtained without changing the gain setting. The gain setting shall be readjusted to obtain a 50 percent full-scale reflection and the readjusted setting shall be recorded as required to provide a basis for recalibration when the secondary standard is unavailable.

1.11.3 Equipment With a Calibrated Gain Control (Attenuator)

When a calibrated gain control attenuator is used, the transducer shall be positioned for a maximum reflection from the reference hole in the secondary standard representing approximately 1/2 the longest inspection distance. This reflection shall be adjusted to mid-scale by varying the gain control accordingly. The difference in decibels between this amplitude and the signal obtained from the first, second, and longest distance reflection obtainable on the secondary standard shall be measured. The differences shall be recorded and plotted on a curve to determine the necessary correction to the amplitude at the various inspection distances. A level of 80 percent of the primary level obtained from the corrected signal heights, is equivalent to the reject/repair line.

1.11.4 Equipment With Electronic Distance Compensation Circuitry

If the difference in amplitude between the first reflection and the reflection obtained from the maximum inspection distance is 1 dB or less, the instrument may be used as is. If not, the procedure used for equipment with a calibrated decibel control shall be used to determine the necessary correction to the reflections obtained at the various inspection distances. This characteristic of the equipment shall be re-examined on a monthly basis or as otherwise stated in paragraph EQUIPMENT QUALIFICATION REQUIREMENTS, and correction factors shall be modified accordingly.

1.11.5 Longitudinal Wave Distance-Amplitude Correction Curve

A distance-amplitude correction curve may be used instead of the calibrated gain control or the electronic circuitry for either the shear or longitudinal wave system as described below:

a. A shear wave distance-amplitude correction curve shall be constructed and drawn on the face of the cathode ray tube (CRT) for inspection of weldments in excess of 38 mm thick when the design of the test equipment permits. The reference hole in the secondary standard SC or DSC shall be used to construct the distance-amplitude correction curve for a minimum of three node points, 1, 2, and 3. The sensitivity of the instrument shall be adjusted to produce 50 percent full-scale response for the maximized primary reflection and the reject/repair line shall be constructed at 80 percent of the established distance-amplitude curve.

b. A longitudinal wave distance-amplitude correction curve shall be constructed and drawn on the face of the CRT when longitudinal waves are to be used in the inspection for material thicknesses exceeding 25 mm, if design of the test equipment permits. The reference hole in the secondary standard shall be used. Instrument sensitivity shall be adjusted to 50 percent full-scale of the maximized response from the reference hole at 1/2 maximum inspection distance. A reject/repair line shall be constructed at 80 percent of the established distance-amplitude curve. The reflection amplitudes to define this curve shall be taken from the faces of the secondary sensitivity standards which are 25 mm, 50 mm and 1/2 maximum inspection distance, and the longest distance obtainable from the secondary standard, respectively, from the reference hole. When a correction curve cannot be drawn on the face of the CRT, one of the distance-amplitude correction methods noted above and submitted under the procedure description shall be applied in accordance with paragraph GENERAL REQUIREMENTS.

1.11.6 Longitudinal Wave Inspections Using Immersion Technique

The reference hole in a secondary standard shall be used for each different inspection distance. Repair/reject limits shall be established by immersing both the search unit and secondary standard in the liquid bath in which the inspection is to be conducted. The procedure noted below shall be used:

a. The longitudinal waves from the search unit shall be directed

toward the face of the secondary standard closest to the reference hole.

b. The search unit shall be positioned for maximum response. The amplitude of reflection shall be adjusted to 50 percent full-scale. The top of that indication shall be marked on the CRT with a wax pencil or by other means. This establishes the standard reference level. A point at 80 percent of the standard reference level shall be calculated and marked. This locates the reject/repair point. The above shall be repeated for each different surface-to-hole distance to establish the reject/repair line.

c. With the gain at the same setting and the primary standard and search unit in air, a maximized reflection shall be obtained from the 1.524 mm reference hole in the primary standard (IIW). Then, this gain setting shall be readjusted to obtain a 50 percent full-scale reflection. The readjusted setting shall be recorded as required to provide a basis for recalibration when the secondary standard is unavailable.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PREPARATION OF MATERIALS FOR INSPECTION

Surfaces shall be free from the following:

3.1.1 Weld Spatter

Spattering or any roughness that interferes with free movement of the search unit or impairs transmission of the ultrasonic vibrations.

3.1.2 Irregularities

Those which could mask or be confused with defect indications.

3.1.3 Weld Backing Strips

Strips that are not to remain in place shall be removed and all sharp edges and valleys shall be eliminated by grinding or other mechanical means.

3.1.4 Dirt

All loose scale, rust, paint, and dirt shall be removed from the coupling surface.

3.2 INSPECTION PROCEDURE

When possible, all welds shall be examined from both sides of the weld and from one surface. If complete inspection cannot be accomplished from one surface, inspection shall be made from another surface that is part of the same joint. Preliminary scanning techniques using an increased instrument gain shall be used to locate possible defects. When possible, gain shall

be increased to a minimum of twice (6 dB) the reference level setting. Final acceptance or rejection shall be evaluated with the equipment properly calibrated and the gain control set at the reference level. The reject/repair line shall be used to evaluate quality of the weld. If a periodic calibration check shows that the equipment is not operating properly or that the system's sensitivity has decreased more than 20 percent (2 dB) from the established sensitivity level, all welds inspected since the prior calibration shall be reexamined. If penetration of the shear waves is questionable, the angle search unit shall be placed in position on one side of the weldment with the waves directed through the weldment. A disconnected angle search unit, plastic or metal wedge or disk, or any good reflector shall be placed in the wave path of the search unit on the far side of the weld to reflect the sound. When good reflections cannot be obtained by either shear or longitudinal waves, the Contractor shall modify the procedures in accordance with paragraph GENERAL REQUIREMENTS.

3.2.1 Test Frequency

The test frequency for ferrous materials shall be as specified in AWS D1.1, Section Inspection, subsection Ultrasonic Equipment, except for thicknesses below 13 mm, frequencies between 2.25 and 5 MHz may be used to obtain increased sensitivity. For materials that are difficult to penetrate, any frequency within the operating range of the equipment may be used. The effective depth of penetration and sound beam divergency shall be demonstrated to the Contracting Officer. See also paragraph 1.3e for frequency of testing on moment frame connections.

3.2.2 Couplants

The choice of couplant is optional with the Contractor, except as follows:

a. The couplant shall be the same as that used for equipment qualification and calibration.

b. Couplants that may corrode the reference standards and material being tested or leave objectionable residues shall not be used.

c. Oils shall not be used in systems intended to handle liquid oxygen.

d. Couplants shall be of the proper viscosity to give good coupling for the surface roughness.

3.2.3 Shear Wave Inspection

Shear wave inspection shall be performed as follows: The search unit shall be placed on the contact surface at a distance from the weld equal to that used when calibrating the equipment.

3.2.4 Longitudinal Flaws

To detect longitudinal flaws, the search unit shall be slowly moved toward and away from the weld far enough to cover its entire cross section, approximately 90 degrees to the weld centerline. The search unit shall be

radially oscillated to the left and right, covering an angle of approximately 30 degrees. During the foregoing movement, the search unit shall be continually advanced parallel to the weld centerline. The rate of movement shall depend on the operator's ability to clearly see and identify all reflections. The amount of movement shall be calculated to ensure that the inspection distance will be great enough to traverse the weld.

3.2.5 Transverse Flaws

To detect transverse flaws when the welded surface is ground flush, the search unit shall be moved along the welded surface in each direction parallel to the centerline of the weld metal with the wave radiating parallel to the weld centerline. To detect transverse flaws when the welded surface is not ground flush, the search unit shall be moved parallel to the weld in each direction, on the adjacent base metal at the top of the weld, with the wave directed at an angle of 30 degrees to the weld centerline.

3.2.6 Longitudinal Wave Inspection

This inspection shall be made as follows:

a. The search unit shall be placed on the contact surface with the wave directed in a straight line through any intervening base metal and through the weldment.

b. The search unit shall then be moved slowly in a direction parallel to the weld centerline and zigzagged across an area equivalent to the welded thickness to make sure that waves penetrate the entire welded cross section.

c. The rate of movement shall be dependent on the operator's ability to clearly see and identify all reflections.

3.3 GENERAL ACCEPTANCE/REJECTION REQUIREMENTS

Discontinuities shall be evaluated only when the ultrasonic equipment is calibrated properly. If discontinuities are detected, the sound beam shall be directed to maximize the signal amplitude. To determine the length of a discontinuity, the search unit shall be moved parallel to the discontinuity axis in both directions from the position of maximum signal amplitude. One-half the amplitude or a 6-dB increase in sensitivity from a point at which the discontinuity signal drops rapidly to the baseline shall be defined as the extremity of the discontinuity. At this point, the scanning surface shall be marked at the position indicated by the center of the transducer. This shall be repeated to determine the other extremity. The length of the discontinuity shall be defined as the distance between these two marks. For discontinuities with signal amplitudes exceeding full screen height, 50 percent of full screen shall be considered half-peak amplitude. At this point, the scanning surface shall be marked at the position indicated by the center of the transducer. This shall be repeated to determine the other extremity. The length of the discontinuity shall be defined as the distance between these two marks. The maximum signal amplitude, length, depth, and position within the inspection zone shall be

determined and reported for discontinuities yielding a signal amplitude equal to or exceeding the reject/repair line. The minimum recordable length of a discontinuity shall be 3 mm.. When evaluating welds joining two members with different thicknesses at the weld, the thickness T shall be the lesser of the two thicknesses. The criteria for acceptance or rejection based on ultrasonic inspection will supplement a visual inspection. The sizes and surface conditions of the welds shall conform to the requirements indicated on the applicable plans and drawings and other sections of the specification. When ultrasonic inspection is used along with radiography, the limits specified under paragraph REFERENCE STANDARDS FOR EQUIPMENT, QUALIFICATIONS, AND CALIBRATION shall be the primary standard.

3.3.1 Inspection of Repairs

All repairs shall undergo the same inspection procedure that originally revealed the discontinuities. Before acceptance, the welds shall meet the standards required for the original weld.

3.4 ACCEPTANCE/REJECTION LIMITS

Welds shall be accepted or rejected by ultrasonic indication in accordance with the following:

3.4.1 Full Penetration Butt Joints and Corner Joints

3.4.1.1 Class III

Welds shall be rejected on the basis of the following:

a. Any discontinuity with a reflection exceeding the established reject/repair line and with a length exceeding 13 mm. Adjacent discontinuities separated by sound metal with a dimension less than twice the length of the longest discontinuity shall be considered a single discontinuity.

b. Any discontinuity with a reflection greater than or equal to 50 percent of the reject/repair line, or with the level 8 dB more than the reject/repair line, and with a length (L) exceeding 50 mm or LT, whichever is greater.

c. If the total cumulative length of discontinuities in any 300 mm of weld length exceeds 75 mm or 2 T, whichever is greater, that weld length shall be rejected.

3.4.2 Full Penetration Tee Joints

Full Penetration Tee Joints (for Incomplete Root Penetration): Any discontinuity with the reflection exceeding the established reject/repair line of the applicable class shall be rejected. Any discontinuity with a reflection exceeding 25 percent of the established reject/repair line, up to and including the reject/repair line, shall be rejected if its length exceeds 1/2 T in a direction transverse to the axis of the weld or LT parallel to the axis for all classes. If the total cumulative length of

discontinuities in any 300 mm of weld length exceeds the limits of the applicable class, that weld length shall be rejected.

3.4.3 Partial and Full Penetration Tee Joints

Partial and Full Penetration Tee Joint Boundaries: The depth of weld penetration and weld cross section width at the through member surface shall be as indicated by applicable plans or drawings. Limits of discontinuities shall be as specified in preceding paragraphs.

3.4.4 Tee Joint Discontinuities

Tee joint discontinuities extending into the through member shall be rejected if reflection exceeds the established reject/repair line.

-- End of Section --

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 316	(1989) ASD Manual of Steel Construction
AISC 317	(1992) ASD Manual of Steel Construction, Vol II: Connections
AISC 326	(2002) Detailing for Steel Construction
AISC 335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design
AISC 350	(1999) Load and Resistance Factor Design (LRFD)Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325M	(2003) Structural Bolts, Steel, Heat Treated, 830 Mpa Minimum Tensile Strength (Metric)
ASTM A 36/A 36M	(2003a) Carbon Structural Steel

ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 563M	(2001) Carbon and Alloy Steel Nuts (Metric)
ASTM A 992/A 992M	(2002) Steel for Structural Shapes for Use in Building Framing
ASTM C 1107	(2002) Packaged Dry, Hydraulic-Cement Grout(Nonshrink)
ASTM C 827	(2001a) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM F 436M	(2003) Hardened Steel Washers (Metric)
ASTM F 844	(2000) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959M	(2002) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 13.01	(1982; R 2000) Epoxy-Polyamide Painting System
SSPC Paint 25	(1997; R 2000) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 316 and AISC 317.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication drawings including description of connections; G

SD-03 Product Data

Shop primer; FIO

Load indicator washers; FIO

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates; FIO

Steel; FIO

Bolts, nuts, and washers; FIO

Shop primer; FIO

Welding electrodes and rods; FIO

Nonshrink grout; FIO

AISC Quality Certification; FIO

Welding procedures and qualifications; FIO

1.4 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Sbd fabrication plant.

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326, AISC 316 and AISC 317. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols.

1.5.2 Certifications

1.5.2.1 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel (plates and bars)

ASTM A 36/A 36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A 992/A 992M Grade 50.

2.1.3 Structural Steel Tubing

ASTM A 500, Grade B.

2.1.4 Steel Pipe

ASTM A 53, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 High-Strength Structural Steel and Structural Steel Tubing

2.2.1.1 Bolts

ASTM A 325M , Type 1

2.2.1.2 Nuts

ASTM A 563M , Grade and Style as specified in the applicable ASTM bolt standard.

2.2.1.3 Washers

ASTM F 436M , plain carbon steel.

2.2.2 Foundation Anchorage

2.2.2.1 Bolts

ASTM A 307.

2.2.2.2 Nuts

ASTM A 563 , Grade A, hex style.

2.2.2.3 Washers

ASTM F 844.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Nonshrink Grout

ASTM C 1107, with no ASTM C 827 shrinkage.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 316 and AISC 317 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 GALVANIZING

ASTM A 123/A 123M or ASTM A 153/A 153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 316. Fabrication and assembly shall be done in the shop to the greatest extent possible.

3.2 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.3 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 335 or AISC 350. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.3.1 Common Grade Bolts

ASTM A 307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.3.2 High-Strength Bolts

ASTM A 325M bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Provide load indicator bolts or washers in all ASTM A 325M bolted connections. Direct tension indicator tightening, shall be the only acceptable tightening methods. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.3.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959M . Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436M washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening.

3.4 WELDING
AWS D1.1/D1.1M

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's

recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.6 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.6.1 Welds

3.6.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

-- End of Section --

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SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611	(1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl	(1987; Amended 1991) Diaphragm Design Manual
SDI Pub No 29	(1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Deck Units; G
Accessories ; G
Attachments; G
Holes and Openings; G

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded connections; and the manufacturer's erection instructions.

SD-03 Product Data

Deck Units; G

Design documentation for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments; FIO

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

SD-07 Certificates

Deck Units; FIO
Attachments; FIO

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

SD-12 LEED Documentation

Recycled Content; G,
Manufacturing Plant Location; G,

Manufacturer's statement of steel decking's post-consumer and post-industrial recycled content and location of the manufacturing plant where steel decking was produced in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for steel decking products.

1.4 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be zinc-coated in conformance with ASTM A 653/A 653M, G90 coating class.

2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint to repair damaged deck coating to prevent the formation of rust, except for surfaces to be covered with concrete topping.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 6 mm and over, including but not limited to:

2.4.1.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

2.4.1.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.1.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm; welding washers, 1.52 mm; cant strip, 0.75 mm; other metal accessories, 0.91 mm ; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

The steel erection shall conform to the requirements of the OSHA Steel Erection Standard, 29 CFR Part 1926, Subpart R- Steel Erection, Effective Date January 18, 2002. This standard may be obtained from the OSHA web site at <http://www.osha.gov>. Erection of deck and accessories shall be

in accordance with SDI Pub No 29, SDI Diaphragm Manual and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Shoring, if required, shall be in position before concrete placement begins in composite or form deck. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 16 mm diameter puddle welds to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 50 mm. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl. Immediately recertify, or replace with qualified welders, those welders who have passed qualification tests but are producing unsatisfactory welding.

3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 150 mm across require no reinforcement. Holes and openings 150 to 300 mm across shall be reinforced by 1.204 mm thick steel sheet at least 300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm on center. Holes and openings larger than 300 mm shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. The deck manufacturer and Contracting Officer shall approve holes or openings larger than 300 mm prior to drilling or cutting. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

3.4 PREPARATION OF FIRE-PROOFED SURFACES

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all

grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

3.5 HANGERS

Provide clips or loops for suspended ceilings where slots or holes are punched in decking for installation of pigtails or decking manufacturer's standard connection as approved by the Contracting Officer. All connections must be to the concrete not to the metal deck itself.

-- End of Section --

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

The Chapel facility is a wood structure framed primarily with glulam members, dimensional lumber and a structural insulated panel roof deck. This section applies to miscellaneous cold formed members indicated or as required to complete the work.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISI SG02-1	(2001) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 370	(2003a) Mechanical Testing of Steel Products
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel

ASTM C 955	(2003) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM E 329	(2002) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J78	(1998) Steel Self Drilling Tapping Screws

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components; G

a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.

b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.

c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Manufacturer's technical literature covering products; G

Steel studs, tracks, bracing, bridging and accessories. Section properties and installation instructions.

SD-05 Design Data

Metal framing calculations; G

SD-07 Certificates

Cold-formed metal framing

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

SD-12 LEED Documentation

Recycled Content; G,
Manufacturing Plant Location; G,

Manufacturer's statement of cold form metal framing's post-consumer and post-industrial recycled content and location of the manufacturing plant where cold form metal framing was produced in accordance with LEED-NC RG.

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for cold form metal framing products.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.6 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the

structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG-973. Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section 09100 METAL SUPPORT ASSEMBLIES. Metal suspension systems for acoustical ceilings are specified in Section 09510 ACOUSTICAL CEILINGS.

1.7 MAXIMUM DEFLECTION

Wall deflections shall be computed on the basis that studs withstand all lateral forces independent of any composite action from sheathing materials.

1.8 QUALITY ASSURANCE

1.8.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

1.8.2 Design Data Required

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C 955 and the following.

2.1.1 Studs and Joists of 1.5 mm and Heavier

Galvanized steel, ASTM A 653/A 653M, SS Grade 50, Z180

2.1.2 Studs and Joists of 1.2 mm and Lighter

Studs and Joists of 1.2 mm and Lighter, Track, and Accessories (All Gages): Galvanized steel, ASTM A 653/A 653M, SS, Grade 345 230 MPa Z180

a. Material shall be corrosion-resistant steel complying with ASTM A 653M, having the following minimum yield strengths and a G 60 minimum zinc coating:

(1) Studs, Tracks and accessories- Fy = 230 MPa
(2) Rafters- Fy = 345 MPa

b. Minimum design thickness:

(1). Studs and Tracks: 1.15 mm unless noted otherwise on drawings.
(2). Joists: Thickness as shown on the drawings.
(3). Bracing and bridging: Thickness as shown on the drawings.
(4). Accessories: Standard thickness as provided by the manufacturer.

c. Stud and Track web depth: 150 mm

d. Stud flange width: 51 mm unless noted otherwise on drawings.

e. Stud effective section properties unless noted otherwise on drawings:

(1). Sx = 14300 mm3
(2). Ix = 1117000 mm4

f. Joist effective section properties as shown on the drawings.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 1200 mm on center and shall be legible and easily read. The product marking shall include the following:

a. An ICBO number.

b. Manufacturer's identification.

c. Minimum delivered uncoated steel thickness.

d. Protective coating designator.

e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J78 of the type, size, and location as shown on the drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, FS TT-P-664.

2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI SG02-1. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 1.2 mm.

3.1.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-1. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 General Requirements

a. Prefabricated frames shall be square, with components attached to prevent racking during fabrication, transportation, and lifting. Design and construction of frames shall include provisions for lifting.

b. Cutting of steel framing shall be by saw, shear, or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.

c. Temporary bracing shall be provided and remain in place until work is permanently stabilized.

d. Abutting lengths of track shall be butt-welded, spliced, or each length securely anchored to a common structural element. Track shall be securely anchored to the supporting structure as shown on the drawings.

e. Splicing of framing components, other than track and tension members, is not permitted.

f. Wire tying of framing members is not permitted.

g. Include blocking and backing as required for exterior sheathing and siding, bathroom accessories, cabinets, plumbing, fixtures and miscellaneous

accessories.

3.2.2 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 75 mm from the edge of concrete slabs.

3.2.3 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 600 mm wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG-973, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

LOAD	HEIGHT	BRACING
Wind load only	Up to 3000 mm	One row at mid-height
	Over 3000 mm	Rows 1500 mm o.c. maximum
Axial load	Up to 3000 mm	Two rows at 1/3 points
	Over 3000 mm	Rows 900 mm o.c. maximum

3.2.4 Non-Load Bearing Walls

a. Studs shall be spaced at 406 mm inches on center.

b. Studs shall be plumbed, aligned, and secured to the continuous runner tracks at each end, unless the stud end terminates at a deflection track.

c. Tracks shall be securely anchored to the supporting structure as shown on the drawings.

d. Bridging spaced at 1220 mm shall be installed prior to the installation of facing materials.

e. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall.

f. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.

g. Installation of sheathing, wallboards, or any other collateral material shall be performed in accordance with the product manufacturer's specifications.

h. Components (Deflection Track and/or Slide Clips) shall be provided at locations shown on the drawings to accommodate potential movements of Primary Frames. Construction shall accommodate a vertical movement of 20 mm.

3.2.5 Erection Tolerances

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 6 mm from intended position;

(2) Plates and runners: 6 mm in 2400 mm from a straight line;

(3) Studs: 6 mm in 2400 mm out of plumb, not cumulative; and

(4) Face of framing members: 6 mm in 2400 mm from a true plane.

3.2.6 Special Inspection and Testing for Seismic-Resisting Systems

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(2003) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	(2002) Standard for Fixed Ladders and Safety Requirements
ANSI MH28.1	(1997) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 467/A 467M	(2001) Machine and Coil Chain
ASTM A 475	(1998) Zinc-Coated Steel Wire Strand
ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM B 429	(2002) Aluminum-Alloy Extruded Structural Pipe and Tube

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(2000) Metal Bar Grating Manual
NAAMM MBG 532	(2000) Heavy Duty Metal Bar Grating Manual

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-344	(Rev B) Lacquer (Clear Gloss)

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steeple Access Ladder; G,

Detail drawings indicating material thickness, type, grade, and class; dimensions; fabrication; and erection details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions.

SD-03 Product Data

Miscellaneous Metal Items; G.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: access doors and panels, handrails and guardrails, steel stairs, and recessed entrance grating.

SD-04 Samples

Miscellaneous Metal Items; G.

Samples of the following items: access doors and panels, safety nosing, and recessed entrance grating. Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

SD-12 LEED Documentation

Recycled Content; G,
Manufacturing Plant Location; G,

Manufacturer's statement of steel stairs and handrails' post-consumer and post-industrial recycled content and location of the manufacturing plant where steel stairs and handrails were produced in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for miscellaneous metal products.

1.4 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.5 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.6 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp

lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.7 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.8 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.9 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 INTERIOR ACCESS DOORS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 1.52 mm (16 gauge) steel with welded joints and finished with anchorage for securing into construction. Frames located in drywall shall utilize drywall bead construction such that drywall finish covers frame and only door is visible. Access doors shall be sized as indicated. Where no size shown, access doors shall be a minimum of 350 by 500 mm and of not lighter than 1.9 mm (14 gauge) steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame with a concealed, continuous piano hinge with stainless steel pin and shall be provided with a flush face,

screw driver operated latch when located in rooms that are normally locked to occupants (such as Mechanical, Electrical, Telecom and Storage Rooms). At all other areas, doors shall be provided with a mortise lock matching lock hardware and keying systems as specified in SECTION: 08710 DOOR HARDWARE. Exposed metal surfaces shall have a shop applied prime coat. All access doors located in fire rated walls shall be tested and rated by an independent testing laboratory to at least match the fire rating of the wall.

2.2 EXTERIOR ACCESS DOORS

Exterior access doors shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 2 mm thick extruded aluminum. Frames located in brick shall be mortared into the wall during brick placement. Frames and associated back boxes located in concrete shall be cast in place. Access doors shall be sized as indicated. Where no size shown, doors shall be a minimum of 300 by 300 mm or larger where device being accessed requires more room. Door panel shall be aluminum on all faces, and not lighter than 1.5 mm thick, with 50 mm thick fully contained fiberglass insulation. Access doors shall be hinged to frame with a concealed, continuous piano hinge with stainless steel pin. Doors shall be provided with a flush face, mortise lock matching lock and keying hardware as specified in SECTION: 08710 DOOR HARDWARE. Entire door perimeter shall be provided with a flexible gasket providing a complete air and water seal. Exposed metal surfaces (except lock cylinders) shall have an anodized finish. Finish color as indicated.

2.3 STEEL CORNER GUARDS AND SHIELDS

Corner guards and shields for jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry, concrete or wood with welded steel straps or end weld stud anchors. Corner guards on exterior shall be galvanized and painted to match adjacent surface. Corner guards specified in this section are intended for areas and assemblies not occupied by visitors, including Mechanical Room and Mechanical Equipment Platform. For guards located in finished areas see SECTION: 10260 WALL AND CORNER GUARDS.

2.4 PIPE GUARDS (BOLLARDS)

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black paint finish, or as indicated.

2.5 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

2.6 FIRE EXTINGUISHER CABINETS

See SECTION: 10520 FIRE EXTINGUISHER CABINETS AND ACCESSORIES.

2.7 FLOOR GRATINGS AND FRAMES

Includes floor gratings and frames used in service and utility (non-public) areas, such as mechanical rooms. Recessed entrance gratings are specified in paragraph 2.16. Carbon steel grating shall be designed in accordance with NAAMM MBG 531 or NAAMM MBG 532 as appropriate to meet the indicated load requirements. Edges shall be banded with bars 6 mm less in height than bearing bars for grating sizes above 19 mm Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

2.8 HANDRAILS

Handrails shall be designed to resist a concentrated load of 890 N (200 pounds) in any direction at any point of the top of the rail or 292 Newtons per meter (20 pounds per foot) applied horizontally to top of the rail, whichever is more severe.

2.8.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53/A 53M or structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Steel railings shall be 40 mm nominal size. Railings shall be hot-dip galvanized and shop primed. Pipe collars shall be hot-dip galvanized steel. Steel handrails shall be used where indicated and at interior locations only.

a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs to create a radius and the pipe is not crushed.

b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.8.2 Aluminum Handrails

Handrails shall consist of 40 mm nominal Schedule 40 pipe ASTM B 429. Railings and pipe collars shall be anodized aluminum, color as indicated. All fasteners shall be Series 300 stainless steel.

a. Jointing shall be by one of the following methods:

(1) Flush type rail fittings, welded and ground smooth with splice locks secured with 10 mm recessed head setscrews.

(2) Mitered and welded joints, made by fitting post to top rail and intermediate rail to post and corners, shall be groove welded and ground smooth. Splices, where allowed by the Contracting Officer, shall be butted and reinforced by a tight fitting dowel or sleeve not less than 150 mm in length. Dowel or sleeve shall be connected to one side of the splice by tack welding or by using epoxy cement.

(3) Railings shall be assembled using slip-on aluminum-magnesium alloy fittings for joints. Fittings shall be fastened to pipe or tube with 6 mm or 10 mm stainless steel recessed head setscrews. Assembled railings shall be provided with fittings only at vertical supports or at rail terminations attached to walls. Expansion joints shall be at the midpoint of panels. A setscrew shall be provided in only one side of the slip-on sleeve. Alloy fittings shall conform to ASTM B 26/B 26M.

b. Removable sections, toe-boards and brackets shall be provided where indicated, using flange castings as appropriate.

2.9 GUY CABLES

Guy cables shall be prestretched, galvanized wire rope of the sizes indicated. Wire rope shall conform to ASTM A 475, high strength grade with Class A coating. Guys shall have a factory attached clevis top-end fitting; guys shall have a factory attached open-bridge strand socket bottom-end fitting; guys shall be complete with oval eye, threaded anchor rods. Fittings and accessories shall be hot-dip galvanized.

2.10 LADDERS

Ladders shall be galvanized steel or aluminum, fixed rail type in accordance with ANSI A14.3. Ladder configuration shall comply with OSHA Standard 1926.1053

2.10.1 "LadderUp" Safety Post

Ladder accessing steeple through floor door shall be equipped with a "LadderUp" Safety Post (Model LU-1) device as manufactured by The Bilco Company, New Haven CT or approved equal. Post shall be fabricated of steel high strength square tubing. All hardware shall be Type 316 stainless steel. Post shall have manufacturer's standard finish.

2.11 METAL GRID WALKWAYS

Metal grid walkways shall be designed to provide pedestrian traffic access at mechanical equipment platforms and shall be 2.0 mm (14 gauge) minimum galvanized steel. The walkway shall consist of metal planks, 610 by 3 050 or 3 650 mm, bolted or welded to supports as indicated. Other sizes may be furnished if approved. In addition to end supports, a midspan support shall be provided when required to limit deflection. End supports shall be

located to avoid uplift and to provide continuous runs.

2.12 MIRROR FRAMES

See SECTION: 10800 TOILET ACCESSORIES.

2.13 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.14 RECESSED ENTRANCE GRATING (EXTERIOR)

Provide grate of Type 304 stainless steel of self-cleaning, I-beam type design and conforming to ASTM A 167. Grating primary members shall run perpendicular to the direction of foot traffic. Each juncture of the surface wires to their support shall have electric resistance welded joints. Provide recessed cast in place frames for entry grates of stainless steel, in sizes shown, or as standard with manufacturer such that surface of grating is flush with adjacent pavement surface. Anchor frames in concrete with anchor pins or bolts. Miter corners to ensure accurate fitting. Unit construction shall support minimum load of 500 kilograms per square meter. Surface finish will be satin stainless steel. Concrete recess depth shall be as indicated on drawings, or as required by the mat or grate thickness, and sloped to drain.

2.15 RECESSED FLOOR MATS (INTERIOR)

See SECTION: 10990 MISCELLANEOUS BUILDING SPECIALTIES.

2.16 REMOVABLE CEILING PANELS

Removable ceiling panels shall be provided in gypsum wallboard ceilings, only as indicated. Panels shall be flush type unless otherwise indicated. Frames for removable panels shall be fabricated of not lighter than 1.52 mm (16 gauge) steel with welded joints and finished with anchorage for securing into construction. Frames shall utilize drywall bead construction such that drywall finish covers frame and only panel is visible. Where no size shown, panels shall be a minimum of 300 by 300 mm. Provide 800 by 800 mm minimum panel size where maintenance personnel must stand inside the opening. Panel shall be not lighter than 1.9 mm (14 gauge) steel, with stiffened edges, complete with attachments. Panel shall be attached to frame with screws in each corner, or concealed, cam type latches. Provide retention clip or removable cable retainer to prevent panel from free falling when all attachment devices are released. Removable panels shall not be located in corridors or stairs. Exposed metal surfaces shall have a shop applied prime coat. Finish coat shall match adjacent surface.

2.17 SAFETY CHAINS

Safety chains shall be galvanized welded steel, proof coil chain tested in accordance with ASTM A 467/A 467M, Class CS. Safety chains shall be straight link style, 5 mm diameter, minimum 39 links per meter (12 links

per foot) and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 10 mm bolt with 19 mm eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

2.18 SAFETY NOSING

Safety nosings shall be of cast aluminum with cross-hatched, abrasive surface. Nosing shall be 75 mm wide and terminating at not more than 150 mm from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 19 mm long. Integrally cast mushroom anchors are not acceptable.

2.19 SHELVING

Shelving shall conform to ANSI MH28.1 and shall be bolted open and capable of resisting a uniform load of 500 kg per meter. Minimum dimensions and number of shelves shall be as indicated.

2.20 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36/A 36M. Stairs and accessories shall be shop primed. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill. Railing materials as indicated. Coordinate stair and landing surfaces as detailed.

2.21 EXPANDED METAL STORAGE CAGE

Panels shall be 16 gauge steel mesh with 38 mm openings. The inner door frames shall be 12 gauge steel of 38 mm x 25 mm angle. Outer door frames shall be 14 gauge steel 38 mm x 25 mm channel. Side panel frames shall be 14 gauge 32 mm x 32 mm angle steel with horizontal reinforcement. Doors shall be prehung with transom. Height of door section is 2100. Door section has three 50 mm x 50 mm steel pin butt hinges, two point contact with concealed drop-rod, and one padlock hasp. The finish shall be one coat shop dipped grey enamel, except galvanized components. The top panel will be 38 mm, 16 gauge expanded metal with clips and 32 mm x 32 mm 14 gauge slotted angle.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 ACCESS DOORS

An access door 300 by 300 mm shall be installed directly below or adjacent to each valve, flow indicator, damper, air splitter, and any other concealed mechanical, electrical, or telecommunications equipment or device that is located above the ceiling, other than an acoustical ceiling, or behind a wall and that would otherwise not be accessible.

3.3 REMOVABLE ACCESS PANELS

Where indicated, a removable access panel not less than 300 by 300 mm shall be installed directly below or adjacent to each valve, flow indicator, damper, air splitter, and any other concealed mechanical, electrical, or telecommunications equipment or device that is located above the ceiling, other than an acoustical ceiling, or behind a wall and that would otherwise not be accessible.

3.4 INSTALLATION OF PIPE GUARDS (BOLLARDS)

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.5 INSTALLATION OF DOWNSPOUT BOOTS

Install boots to provide the indicated distance above grade. Coordinate boot positions with downspout positions.

3.6 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.6.1 Installation of Steel Handrails

Installation in cast in place concrete shall be in pipe sleeves embedded in concrete with anchorage covered with standard pipe collar pinned to post. Installation at steel stringers shall be in base plates bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts in concrete or through-bolted to a back plate in stud wall construction. Unsecured handrail return to a wall is permitted where indicated. Guardrail mounted handrail shall be returned and welded to guardrail as indicated.

3.6.2 Installation of Aluminum Handrails

Installation shall be by means of flanges anchored to concrete or masonry by expansion shields. Bolts used to anchor aluminum alloy flanges shall be stainless steel of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or portland cement concrete, the contact surface shall be given a heavy coating of bituminous paint or asphalt varnish.

3.7 ERECTION OF GUY CABLES

Guy cables shall be erected as indicated. Anchor rods shall be cast in concrete located and reinforced as shown.

3.8 LADDERUP SAFETY POST

Verify ladder geometry prior to fabrication of components. Do not begin installation of safety post before confirming that it will not impact steeple access by other trades. Comply with all manufacturer's written instructions for installation. Use manufacturer's fasteners.

3.9 INSTALLATION OF METAL GRID WALKWAYS

Walkways shall be installed where indicated for equipment access.

3.10 RECESSED ENTRANCE GRATING

Contractor shall verify field measurements prior to releasing materials for fabrication by the manufacturer. A mat frame shall be used to ensure recess accuracy in size, shape and depth. Drain pit shall be formed by blocking out concrete when frames are installed. Pit shall be dampproofed after concrete has set. Frames shall be assembled onsite and installed so that upper edge will be level with finished adjacent pavement surface. A cement base shall be screeded inside the mat recess frame area using the edge provided by the frame as a guide. The frame shall be anchored into the cement with anchor pins a minimum of 610 mm on centers.

3.11 MOUNTING OF SAFETY CHAINS

Safety chains shall be mounted 1070 mm and 610 mm above the floor.

3.12 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

-- End of Section --

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SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T101	(2001) National Design Specification (NDS)for Wood Construction

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 317	(1992) ASD Manual of Steel Construction, Vol II: Connections

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 110	(1997) Standard Appearance Grades for Structural Glued Laminated Timber
AITC 111	(1979) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
AITC 190.1	(2002) Structural Glued Laminated Timber
AITC OT-01	(1994) Timber Construction Manual

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2	(2001) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA C20	(1999) Structural Lumber Fire-Retardant Treatment by Pressure Processes
AWPA C27	(1999) Plywood - Fire-Retardant Treatment by Pressure Processes
AWPA C9	(2000) Plywood - Preservative Treatment by Pressure Processes
AWPA M4	(2001) Standard for the Care of

	Preservative-Treated Wood Products
AWPA P5	(2002) Standard for Waterborne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E445S	(2001; R 2002) Performance Standards and Policies for Structural-Use Panels (APA PRP-108)
APA EWS R540C	(1995; R 1996) Builder Tips Proper Storage and Handling of Glulam Beams
APA EWS T300E	(2002) Technical Note: Glulam Connection Details

ASTM INTERNATIONAL (ASTM)

ASTM A 108	(1999) Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D 2559	(2004) Standard Specification for Adhesives for Structural Laminated Wood Product for Use Under Exterior (Wet) Use Exposure Conditions
ASTM D 2898	(1994; R 1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D 3498	(2003) Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM F 547	(2001) Nails for Use with Wood and Wood-Base Materials

U.S. DEPARTMENT OF COMMERCE (DOC)

PS1	(1995) Construction and Industrial Plywood (APA V995)
PS2	(1992) Wood-Based Structural-Use Panels (APA 5350)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Wood Members; G, EC-DB-AS
Installation of Framing; G, EC-DB-AS

Drawings of structural laminated members shall show full dimensions of each member. Indicate species and stress grade of lumber, type of glue, and other variable in required work. Drawing shall also show framing system, sizes and spacing of members, loads and cambers, bearing, connection and anchor details, bridging and bracing, and framed openings. .

Nailers and Nailing Strips; G

Drawings of field erection details, including materials and methods of fastening nailers.

SD-03 Product Data

Structural Wood Members; G, EC-DB-AS

Design analysis and calculations of structural laminated members, connections other fabricated structural members showing design criteria used to accomplish the applicable analysis.

Provide technical data on wood preservative materials, application technique, and resultant performance information.

Qualifications;G

Structural Laminated member manufacturer shall provide AITC certification and List of successful installations as specified below.

The Contractor shall submit a list containing name and location of successful installations of similar type of Structural laminated members specified herein.

SD-04 Samples

Structural Laminated Members Finish; G, EC-DB-AS

Submit samples of Factory finish on representative wood species.

SD-07 Certificates

Grading and Marking; G

Structural Laminated Members, provide factory-glued timber units, produced by an AITC licensed firm, qualified to issue the AITC "Quality Inspected" mark.

Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements.

SD-12 LEED Documentation

Manufacturing Plant Location; G
Regional Material Extraction; G

Manufacturer's statement location of the manufacturing plant where material was produced and percentage of the products' raw materials extracted regionally in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for wood products.

1.4 DELIVERY AND STORAGE

Timber materials shall be delivered to the site in undamaged condition, stored off ground in a waterproof covering which will not allow ultraviolet ray penetration, well ventilated areas, and protected from extreme changes in temperature and humidity.

In addition to the above, laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540C. Schedule delivery and installation of glue laminated wood members to avoid extended on site storage. Time of removal of factory wrapping is optional, but, it must be emphasized that factory applied wrapping provides additional protection from damage in handling and in-transit only. If further utilization of the wrap is desired for protection after shipment, the members should be inspected and provided with additional protection as necessary. If it is impractical to replace wrapping, ALL of it should be removed. Do not leave members partially exposed due to potential sun bleaching. Do not allow

moisture to accumulate inside wrapping.

1.5 Qualifications

Manufacturer of Structural laminated members shall be specialized in manufacture of glue laminated structural units with three years minimum experience, and certified by the AITC and comply with AITC A190.1. Company shall submit a copy of the certification.

The Contractor shall submit a list containing name and location of successful installations of similar type of Structural laminated members specified herein.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of Rough Carpentry with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Verification that moisture content does not exceed specified limits.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Verification that wood products are fire retardant or preservative treated in all areas specified.

(6) Inspection of all wood members to ensure complete attachment to adjacent framing and achieving a tight joint fit.

(7) Structural Laminated members are fabricated with camber built in per AITC standards.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or

grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 Fabricated Structural Members

Factory mark each piece of glued-laminated timber with AITC Quality Inspected Mark. Place AITC mark on timber surfaces that will not be exposed in completed work.

2.1.1.3 Plywood and Other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and wood structural panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. The following items shall be treated:

a. Wood members in contact with or within 455 mm of soil.

c. Wood members exposed to the weather and those used in roofing systems or as nailing strips or nailers over fiberboard or gypsum-board wall sheathing as a base for wood siding.

d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.

e. Wood members in contact with concrete that is in contact with soil or that is exposed to weather.

2.1.3.1 Lumber and Timbers

Lumber and timbers except for Structural Laminated members shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg/cubic meter intended for above ground use.

b. 6.4 kg/cubic meter intended for ground contact and fresh water use.

2.1.3.2 Structural Laminated members

Laminated members shall received a Factory applied penetrating sealer or Factory Finish stain or clear sealer.

After end cutting each member to final length, seal with penetrating sealer seal with sealer coat to ends and other cross-cut sections in accordance with AITC requirements.

2.1.3.3 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg/cubic meter intended for above ground use.

b. 6.4 kg/cubic meter intended for ground contact.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber Except Roof Planking: 19 percent maximum.

c. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.5 Fire-Retardant Treatment (FRT)

Fire-retardant treated wood shall be pressure treated in accordance with AWPA C20 for lumber and AWPA C27 for plywood. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A and Exterior Type. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898 prior to being tested for compliance with AWPA C20 or AWPA C27. Items to be treated include: plywood used for backboards and mounting boards for mechanical or electrical equipment, framing required to be FRT when used in a listed, fire rated wall, floor or roof/ceiling assembly. Fire retardant treatment of plywood used in roof construction is prohibited due to accelerated decay of treated products in wet environments.

2.1.6 Structural Wood Members

Species and grades shall be as listed in AF&PA T101. Structural lumber used in fabrication of fabricated structural members for engineered uses,

except laminated members, shall be Douglas Fir Larch or Hem-Fir. The minimum allowable bending stress for studs, joist, post and beams shall be the larger of the values shown on the design drawing and as listed in the AF&PA T101. Design of members and fastenings shall conform to AITC OT-01.

2.1.6.1 Structural Glued Laminated Members

Glued Laminated Timber is hereby defined to include wood member fabricated from 19mm (1 inch) to 38 mm (2 inch)nominal thickness lumber glued to with the grain of all laminates approximately parallel longitudinally.

Glued Laminated Members shall conform to AITC A190.1 and applicable lumber association standards cited therein for grades required to achieve glued-laminated timber requirements for allowable stress appearance, fabrication limitations and species. Provide sizes and shapes shown on plans. Final cross sections will be based on manufacturer's standard widths and depths. Manufacturer to provide deign values (stresses) to fulfill structural demand in accordance with applicable provisions of ATC 117. Adhesives used in fabrication shall meet the requirements of wet use service per ASTM D 2559.

Members shall conform to AITC 110 for appearance grades by location:

Premium appearance grade
Frames in Worship and Assembly areas
Beams in Worship and Assembly areas

Architectural appearance grade
Frames exposed in North and South Lobbies
Beams exposed in North and South Lobbies

Industrial appearance grade
All other frames and beams

Members concealed from view shall be sealed with a penetrating sealer. Members exposed to view shall be prepared for finish and individually wrapped for protection. Members shall be complete with hardware for joining laminated members and for their connection to other construction.

Do not splice or join members in locations other than that indicated, without permission. Fabricate steel hardware and connection per AISC 317 and spec Section 05500 requirements with joints neatly fitted, welded, and ground smooth.

2.1.7 Sheathing

Wall sheathing shall be plywood or wood structural panels.

2.1.7.1 Plywood

Plywood shall conform to PS1, APA E445S or PS2, Grade C-D or sheathing grade with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm on center and a span rating of 24/0 or greater for supports 600 mm

on center.

2.1.7.2 Wood Structural Panels

Panels shall meet the qualification requirements of APA E445S or PS2 for rated sheathing, Exposure 1 or Structural I rated sheathing, Exposure 1. Sheathing for roofs or walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm on center and shall have a span rating of 24/0 or greater for supports 600 mm on center.

2.1.8 Subflooring

2.1.8.1 Plywood

Plywood shall have 15 mm (19/32 inch) thickness and shall conform to PS1, APA E445S or PS2; Grade C-D or Sheathing grade , Exposure 1 with tongue and groove edges. Attach Floor sheathing with 10d common nails spaced 150mm oc at supports. Field glue using adhesive meeting APA AFG-01 Specification. Minimum span rating for subflooring shall be 24/16 for supports 400 mm on center, and 48/24 for supports 600 mm on center. Minimum span rating for combination subfloor-underlayment shall be 16/O for supports 400 mm on center and 24/O for supports at 600 mm on center.

2.1.8.2 Wood Structural Panels

Rated wood structural panels shall be qualified for subflooring or combination subfloor-underlayment under APA E445S or PS2. Subflooring shall be rated sheathing with a span rating of 24/16 or greater for supports 400 mm on center and shall have span rating of 48/24 or greater for supports 600 mm on center. Combination subfloor-underlayment shall have a span rating of 16/O or greater for supports 400 mm on center and shall have span rating for 24/O or greater for supports 600 mm on center.

2.1.9 Shear Wall Panels

Panels used in shear wall construction shall be of the span rating and thickness shown on the drawing and shall be plywood conforming to PS1 or PS2, Grade C-D with exterior glue; or wood structural panels conforming to APA E445S or PS2, Structural I rated sheathing, Exposure 1.

2.1.10 Structural Insulated Panels (SIPs)

See Section 06120.

2.1.11 Miscellaneous Wood Members

2.1.11.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm (inch)
Bridging	19 x 64 (1 x 3) or 19 x 89 (1 x 4) for use between members 38 x 286 (2 x 12) and smaller; 38 x 89 (2 x 4) for use between members larger than 38 x 286 (2 x 12).
Corner bracing	19 x 89 (1 x 4).
Furring	19 x 64 (1x 3)
Grounds	Plaster thickness by 38.
Nailing strips	19 x 64 (1 x 3) or 19 x 89 (1 x 4) when used for interior finish, otherwise 38mm(2 inch)stock, or as detailed.

2.1.11.2 Wood Bumpers

Bumpers shall be of the species and grade in accordance with TABLE II at the end of this section, size as shown.

2.1.11.3 Sill Plates

Sill plates shall be standard or number 2 grade.

2.1.11.4 Blocking

Blocking shall be standard or number 2 grade.

2.1.11.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.2.1 Anchor Bolts and Welded Headed Studs

Anchor bolts shall be ASTM A 307, size as indicated on drawings, complete with nuts and washers. Glulam Arch Frame shall be anchored with a steel plate and Welded Headed Studs assembly as shown on the drawing. Welded Head Studs shall be per ASTM A 108

2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use or as shown on drawing. Finish options include zinc compounds, cadmium, and aluminum paint

impregnated finishes.

2.2.3 Clip Angles

Clip angle shall be as shown on drawing. If the angles are not called out in the drawing, it shall be steel, 5 mm thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.2.4 Expansion Shields

Type and size best suited for intended use.

2.2.5 Joist Hangers

Steel or iron, zinc-coated, size to fit members where used or as specified in the drawings. Sufficient strength to develop the full strength of supported member, complete with any special nails required.

2.2.6 Metal Bridging

Optional to wood bridging; zinc-coated steel, size and design to provide rigidity equivalent to specified wood bridging.

2.2.7 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 25 mm into supports. In general, 8-penny or larger nails shall be used for nailing through 19 mm thick lumber and for toe nailing 38 mm thick lumber; 16-penny or larger nails shall be used for nailing through 38 mm thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T101. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T101. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.2.8 Timber Connectors

Unless otherwise specified, timber connectors shall be in accordance with TPI 1, APA EWS T300E or AITC OT-01or AITC 190.1.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

General framing shall be in accordance with AF&PA T101. Members shall be

closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of AF&PA T101for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. . When joists, beams, and girders are placed on masonry or concrete, a wood/steel base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. The glulam arch frames shall be anchored to the foundation as shown on the drawings.

3.1.2 Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing.

Do not splice or join members in locations other than that indicated, without permission. Fabricate steel hardware and connection per AISC requirements with joints neatly fitted, welded, and ground smooth.

Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided. Scratches and abrasions of factory-applied sealer shall be treated with two brush coats of the same sealer used at the factory.

3.1.3 Partition and Wall Framing

Unless otherwise shown, studs shall be spaced 410 mm on centers. Studs shall be doubled at interior openings. At exterior openings, provide number of studs indicated. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 1200 mm . Plates of partitions resting on concrete floors shall be anchored in place with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 1800 mm between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 900 mm on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 1200 mm and well spiked together.

3.1.4 Floor (Ceiling) Framing

Except where otherwise indicated beams shall have bearings not less than 100 mm on concrete or masonry and 40 mm on wood or metal. Trimmers, headers, and beams framing into carrying members at the same relative levels shall be carried on joist hangers or as shown on drawings. Beams shall be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors shall be framed with headers and trimmers. Headers carrying more than two beams and trimmers supporting headers carrying more than one beam shall be doubled, unless otherwise indicated.

3.1.5 Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails . Rafters shall be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails or as shown on drawings. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 1200 mm and well spiked together.

3.1.6 Stair Framing

Stair framing members shall be well spiked together. Rough carriages shall be cut to exact shape required to receive finish treads and risers. Risers shall be of uniform height, and treads shall be of uniform width except as otherwise shown. Trimmers, blocking, and other framing necessary for support of finish treads, risers, newels, and railing shall be provided.

3.2 INSTALLATION OF SHEATHING

3.2.1 Plywood and Wood Structural Panels

Sheathing shall be applied with edges 3 mm apart at side and end joints, and nailed at supported edges at 150 mm on center and at intermediate supports 300 mm on center unless otherwise shown. Nailing of edges shall be 10 mm from the edges, unless otherwise shown.. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.2.2 Wood

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 150 mm and less in width and three nails for boards more than 150 mm in width. Roof sheathing shall not be installed where roof decking is installed.

3.3 INSTALLATION OF SUBFLOORING

3.3.1 Plywood and Wood Structural Panel

Subflooring shall be applied with long dimension at right angles to the supports, with edges 3 mm apart at side and end joints, and nailed at supported edges 150 mm on center and at intermediate supports 300 mm on center unless otherwise shown. Subflooring may be installed with adhesive conforming to ASTM D 3498 and nails spaced at 300 mm on center unless otherwise shown. Each panel shall have end joints made over supports and end joints staggered. Where finish flooring of different thicknesses is used in adjoining areas, wood strips of the thickness required to bring the finish flooring surfaces into the same plane shall be used under the plywood subfloor.

3.4 INSTALLATION OF UNDERLAYMENT

3.4.1 Plywood

Underlayment shall be applied with edges 0.8 mm apart at joints and nailed at edges 150 mm on center and at 200 mm on center throughout remainder of panel for panels 9 mm and thicker. Thinner panels shall be nailed at edges 75 mm on center and at 150 mm on center throughout remainder of panel. Nailing at edges shall be 10 mm from edges. A clearance of 6 mm shall be provided at walls. Joints of underlayment shall not be located directly over parallel joints of subflooring. Power-driven wire staples of lengths recommended by the underlayment manufacturer may be used in lieu of nails. When plywood combination subfloor-underlayment is used in lieu of separate layers, it shall be installed as specified for plywood subfloor, except all joints shall be made over supports with edge and joints spaced 3 mm apart. When plywood combination subfloor-underlayment is tongued and grooved, only end joints shall require support. Tongued and grooved combination subfloor-underlayment shall be applied with joints spaced 3 mm apart. Any surface roughness at nail heads or joints shall be lightly sanded to blend with the undisturbed surface. For floors receiving a vinyl finish flooring, a separate layer of fully-sanded underlayment shall be installed as provided for above over combination subfloor-underlayment panels.

3.5 INSTALLATION OF SHEAR WALLS

Plywood or wood structural panels shall be installed with the long dimension parallel or perpendicular to the supports. Blocking shall be provided behind edges not located over supports. Shear wall construction, nailing, and top and bottom anchorage shall be as shown on drawing.

3.6 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.6.1 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.6.2 Corner Bracing

Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.6.3 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, casework, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 2400 mm for any concealed space. Provide Blocking at all wall mounted door hardware including holders and stops. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.6.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 450 mm on center and staggered. Beginning and ending nails shall not be more than 150 mm for nailer end. Ends of stacked nailers shall be offset approximately 300 mm in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place.

3.6.5 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

3.6.6 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.6.7 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 1800 mm on centers and not more than 300 mm from end of each piece. A minimum of two anchors shall be used for each piece.

3.7 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirements of AF&PA T101 and AITC Timber Construction Manual.

3.8 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

3.9 ERECTION TOLERANCES

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 6 mm from intended position;

(2) Plates and runners: 6 mm in 2400 mm from a straight line;

(3) Studs: 6 mm in 2400 mm out of plumb, not cumulative; and

(4) Face of framing members: 6 mm in 2400 mm from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

(1) Layout of walls and partitions: 6 mm from intended position;

(2) Plates and runners: 3 mm in 2400 mm from a straight line;

(3) Studs: 3 mm in 2400 mm out of plumb, not cumulative; and

(4) Face of framing members: 3 mm in 2400 mm from a true plane.

3.10 TABLES

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
WCLIB 17					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
WWPA G-5					
	Douglas Fir-Larch	X			
	Hem-Fir	X			

-- End of Section --

Section 06120

STRUCTURAL INSULATED PANELS (SIPs)

PART 1 General

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

APA - The Engineered Wood Association (APA)

APA AFG-01	(1984) Adhesives for Field-Gluing Plywood to Wood Framing.

American Standard of Testing Materials

ASTM C-578	(2005) Standard Spec for Rigid, Cellular Polystyrene Thermal Insulation
ASTM D-3498	(2003) Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM E-72	(2005) Conducting Strength Tests of Panels for Building Construction
ASTM E-84	(2005) Standard Test for Surface Burning Characteristics of Building Materials
ASTM E-119	(Rev A) (2000) Standard Test For Surface Burning Characteristics of Building Materials
ASTM E455	(2004) Standard Test for Static Load Testing of Framed Floor or Roof Diaphragm Construction for Building
ASTM E-695	(2003) Standard Test Method of Measuring Relative Floor, and Roof Construction to Impact Loading

DOC Department of Commerce, Voluntary Product Standard

DOC PS2	(2004) Performance Standard for Wood-Based Structural- Use Panels

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as

otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings - G, EC-DB-AS

Manufacturer's standard shop stamped by a registered professional engineer. The drawing(s) shall include locations of special panels, additional blocking, electrical raceways and other fittings. Drawings shall also show field erection details including methods of fastening.

SD-03. Product Data -G, EC-DB-AS

Data sheet, and Design Analysis and calculation of SIPs showing design criteria used to accomplish the applicable analysis.

The Contractor shall submit a list containing name and location of successful installations of similar type of SIPs specified herein.

SD-07 Certificates - G

Manufacturer shall certify that panels have been tested in accordance with ASTM E-72, ASTM E-84, ASTM E-119, and other applicable tests.

Manufacturer shall supply a hard copy product certificate showing compliance to 3rd Party Quality Control Program.

1.3 Delivery and Storage

All panels shall be delivered to the site in undamaged condition, stored off ground in fully protected from exposure to sunlight and moisture. Do not allow panels to be stored in an unsupported manner. Improper storage may cause tolerance problems in the field.

1.4 Contractor Quality Control

The Contractor shall establish and maintain a quality control procedure to assure compliance with Contract requirement. Each panel shall be labeled indicating the maintenance of in-plant Quality Control/Third Party Inspection Service in compliance with national codes.

Provide evidence of 3rd Party Inspection and labeling of all EPS used in the manufacturing of the SIPs. Flame, physical, and thermal properties will be covered by the EPS manufactures Quality Control and Listing Programs.

Any work found not to be in compliance with the contract shall be promptly removed and replace, or corrected in an approved manner.

PART 2 Products

2.1 General

Structural Insulated Panels (SIPs) are factory assembled sandwich panels consist of expanded polystyrene (EPS) cores with wood structural sheathing facings. The panels are used as load bearing roof. The SIPs panel shall be (267mm) overall thickness with (235 mm) thick core , recessed along the panel sides and ends to receive nominal (51 mm) thick solid sawn dimensional lumber, Premier Building Systems Type L Panel, or equal.

2.2 Materials

2.2.1 Core

The core material is Expanded Polystyrene (EPS) foam plastic, complying with ASTM C-578 Type I, with a nominal thickness of (235 mm) and a nominal density of (16 kg/m3). The EPS core shall have a flame spread rating of not more than 75 and a smoked developed rating of not more than 450 when tested in accordance with ASTM E84.

Insulation manufacturer must provide certification of Third Party Inspection and Listing an insulation manufacturing location

2.2.2 Facing

Panel facing material is (16 mm) thick Structural 1, Exposure 1 wood sheathing complying with DOC PS2. The panel shall with an APA or PFS performance rating marking.

2.2.3 Adhesive

The adhesive is Structural grade Type II, Class 2 laminating adhesive meeting the requirement of APA AFG-01 specification or ASTM D-3498.

2.2.4 Splines

The splines for use in joining the SIPs are nominal (51 mm) thick dimensional lumber sized in depth to match the core thickness, or shall be as recommended by the manufacturer. Splines shall be supplied by the panel manufacturer. See Section 06100, Rough Carpentry for dimensional lumber specification.

2.2.5 Fasteners

Fasteners shall be corrosive resistant. All fasteners shall be supplied or recommended by panel manufacturer. Fasteners supplied or sourced by Contractor must be installed per SIPs manufacturer details.

2.2.6 Caulk/Sealant/Adhesive

Caulk, sealant and adhesive shall be compatible with all components of the panel as supplied or recommended by the panel manufacturer and installed as detailed in the manufacturer's literature.

2.2.7 Dimensional Lumber

Plating shall consist of SPF #2 or better, or pre-engineered equivalent.

2x framing to be supplied by the panel manufacturer and installed (where practical) in the factory.

2.3 Performance Characteristics

2.3.1 Thermal Resistance

The SIPs panel (not including air films, cladding materials or reflective barrier) shall have a minimum R value of (4.4 C).

2.3.2 Dimensional Tolerance

Dimensional tolerance shall comply with values listed in the Manufacturer's Quality Control Manual.

2.3.3 Structural Testing

The SIPs panel shall meet or exceed ASTM D72 criteria when tested for Transverse load, Axial compressive load, racking shear, header loading and point loading. The SIPS also shall have a minimum ICBO rated allowable diaphragm capacity of (6.35 KN/m) when tested per ASTM E455.
Impact Testing shall be per ASTM E695.

Tested values shall meet or exceed those stated on the manufacturer's load design charts and the applicable data report.

2.3.4 Fire Testing

The SIPs panel shall be tested per ASTM E-119.

2.3.5 Wind Uplift

Wind uplift shall be calculated for recommended fastening of roof panels by the engineer of record.

2.4 Manufacturer/Contractors

Manufacturer approved to supply panels and material called for in this section are:

1. Premier Building Systems
   4609 70th Ave East
   Fife, WA 98424
   253-926-2020 or 1-800-275-7086

2. Thermal Foams Inc.
   2101 Kenmore Ave
   Buffalo, NY 14207
   716-874-6474

3. AFM R-Control/CushBack
   211 River Ridge Circle, #102
   Burnsville, MN 55337

952-474-0809 or 1-800-255-0176

PART 3 Installation

3.1 General

Installation shall be in accordance with SIPs manufacturer's published instruction, details and the drawings, which are part of the contract documents for the project. Contractor shall notify and obtain permission from the Contracting officer when deviating from the manufacturer's standard details and load design values.

3.2 Protection

Roof panels must be fully protected from weather by roofing materials to provide temporary protection at the end of the day or when rain or snow is imminent. Remove and replace panels which have become excessively wet or damaged before proceeding with installation of additional panels or other related work.

-- End of Section --

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SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C20	(1999) Structural Lumber Fire-Retardant Treatment by Pressure Processes
AWPA C27	(1999) Plywood - Fire-Retardant Treatment by Pressure Processes

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(2003) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM D 2898	(1994; R 1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D 3676	(2001) Rubber Cellular Cushion Used for Carpet or Rug Underlay
ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 547	(2001) Nails for Use with Wood and Wood-Base Materials

FOREST STEWARDSHIP COUNCIL (FSC)

FSC CWP	(2002) Listing of Certified Wood Products

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule #1168 (2003) Adhesive and Sealant Applications

U.S. DEPARTMENT OF COMMERCE (DOC)

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Finish Carpentry; G

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-03 Product Data

Wood Items, Siding and Trim; G

Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

Forest Stewardship Council certification documents.

SD-04 Samples

Wood Bases, Chair Rail, Cornice, and Trim; G

Wood Bases, Chair Rail, Cornice, and Trim samples shall be of sufficient size to show patterns, grain, color ranges, and types, as applicable, of the material proposed to be used.

Panel Products (WP-1 and WP-2) with Stains and Transparent Finish; G

Sample shall be a minimum 450 x 450 mm in size. Sample shall show panel design and configuration per the drawings.

Stain/Color/Finish Samples on Veneer to Be Used; G

Samples shall be submitted within 90 days after Notice to Proceed. Samples shall be a minimum 300 x 300 mm in size.

SD-12 LEED Documentation

Recycled Content; G,
Rapidly Renewable; G,
Manufacturing Plant Location; G,
Regional Material Extraction; G,

Manufacturer's statement of material's post-consumer and post-industrial recycled content, manufacturer's statement of material's rapidly renewable content, location of the manufacturing plant where materials were produced, and percentage of the products' raw materials extracted regionally in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for wood products.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

1.5 CERTIFIED WOOD

A minimum of 50 percent of all lumber and panel products provided under this specification shall be certified wood meeting FSC CWP standards and certification. Provide required documentation perLEED-NC RG.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of finish carpentry with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades and field measurement verification of all dimensions where adjacent construction constrains the installation of woodwork.

(4) Aesthetic consistency of wood grain, surface plane, joints, color, and finish with specified requirements.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 WOOD ITEMS AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), by using recycled wood products and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer. The Contractor shall not use wood products which contain urea formaldehyde per LEED-NC RG. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Fire-Retardant Treatment

Fire-retardant treated lumber shall be pressure treated in accordance with AWPA C20. Fire-retardant treated plywood shall be pressure treated in accordance with AWPA C27. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A and Exterior Type. Treatment and performance inspection shall be by a qualified independent testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898, Method A, prior to being tested for compliance with AWPA C20 or AWPA C27.

2.1.5 Interior Hardwood Trim

Hardwood trim shall be graded in accordance with the National Hardwood Lumber Association Grade Rules for Measurement and Inspection. All hardwood items shall be fabricated to the shapes and sizes indicated. Grades and species for hardwood items shall be as follows:

Hardwood trims, mouldings, wall base, cornice and chair rail shall be maple, east select white, Grade II, kiln dried.

2.1.6 Hardwood Veneer Paneling

Hardwood veneer paneling shall be graded in accordance with the American national Standard for Hardwood and Decorative Plywood and the American Woodwork Institute (AWI)Architectural Woodwork Quality Standards, 8th Edition. Grades and species for hardwood paneling shall be as follows:

1)(All veneer except Wood Paneling-1) White Maple veneer, Grade A, plain-sliced, book matched. Veneer thickness as noted on drawings.

2)(Wood Paneling-1) White Maple veneer, 7 mm, Grade A, plain-sliced, continuous end matched.

2.1.7 Woodwork Items

2.1.7.1 Bulletin Boards

Bulletin boards shall have a hardwood or aluminum frame, 6 mm thick plywood or hardboard back; and a 6 mm thick, dense, smooth faced corkboard face securely cemented to the back.

2.1.7.2 Markerboards

Markerboards shall have a hardwood frame provide to match other trim in the room.

2.1.7.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA G-5, 25 mm thick; or plywood, interior type, Grade A-B, 13 mm minimum thickness, any species group.

2.2 CORK TILE

Cork tile shall consist of 100% high density cork and be solid cork composition throughout the tile. Cork tile shall be prefinished with a minimum 2 coats of water based polyurethane or UV cured acrylic coating. Cork tile shall have a swirling pattern with an inlay pigment laid in a natural color. A monolithic color and/or pattern is not acceptable. Cork tile shall not be less than 300 mm square and the overall thickness shall not be less than 4.8 mm. Cork tile shall conform to ASTM E 648 Class II fire rating and conform to ASTM E 662 with a smoke density less than 450 per NFPA 258. Cork tile shall conform to ASTM D 3676 with a minimum density of 500 kg/cubic meter.

Manufacturers: Duro Design: Cleopatra
AmCork: Bark
Expanko: Coreia

2.3 Cork Tile Polyurethane Sealer

Sealer shall be commercial grade, two-part water, one-part polyurethane sealant approved by the cork manufacturer. The polyurethane sealant shall be a commercial satin finish and dry to a clear sheen. The polyurethane sealant shall have excellent leveling and defoaming characteristics. The VOC's shall be less than the current VOC limits of SCAQMD Rule #1168.

2.4 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied except where noted on wood paneling details. Screws shall be used for attachment to stud; setting and stopping of screws shall be of the same quality as required where nails are used.

3.2 HARDWOOD VENEER PANELING

Paneling shall be applied with grain running vertically. Adjacent panels shall be snugly abutted. Cut panels shall be balanced evenly between wall corners where necessary to fit along a length of wall. Top and bottom

panel edges shall be concealed at base, wainscot paneling, or as indicated. Panels shall be attached with no visible fasteners or seams. Use finish materials and methods as described in this section.

3.3 PLACING CORK TILE

Cork tiles and accessories shall be installed using a commercial grade contact cement. Adhesives shall be prepared and applied in accordance with manufacturers directions. Tile lines and joints shall be square, symmetrical, tight, and even. Keep each tile in true, level plane, except where slope is indicated. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Tile shall be cut, fitted, and scribed to walls and partitions after field tile has been applied.

3.4 FINISHED RAILINGS

Finished railings shall conform to AWI Qual Stds, Premium Grade for transparent finish. Railings shall have a 32mm diameter. Railings shall be erected to form a strong, rigid structure without squeaks or vibrations. Railings shall be secured with concealed fasteners. Guardrails shall be supported as detailed.

3.5 WOODWORK ITEMS

3.5.1 Bulletin Boards and Markerboards

Items shall be installed in accordance with the manufacturer's recommendation.

3.5.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm on center or as required to limit deflection to 6 mm between supports with a load of 525 N per meter. Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm adjustment slots and brackets designed for attachment to standards.

3.5.3 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be hardwood 38 mm in diameter. Rods shall be set parallel with the front edges of the shelving, and shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 1200 mm centers.

3.6 FINISHES

3.6.1 Molding, Interior Trim, Wood Paneling, and Shelving

In preparation for finishing, all trim shall be sanded to remove machine marks, scratches and surface defects that would be highlighted by staining. Trim shall then be brushed off and wiped with a tack rag to remove all

dust. Trim to receive stain shall have a wiping stain applied followed by three coats of satin luster, clear, low VOC, water based polyurethane or clear UV cured polyurethane as noted on drawings. Natural finish materials shall receive three coats polyurethane coatings only. Polyurethane shall be buffed between coats with fine sandpaper or steel wool to remove surface imperfections. After installation, all flaws in the finish caused during the installation shall be lightly sanded and touched up with stain and polyurethane. Stain colors shall be as indicated in the finish schedule, or if not indicated, shall be the same color for all woodwork in a given area of the building. If the location or extent of stain colors is unclear the Contractor shall ask for clarification from the Contracting Officer.

3.6.2 Sealing Cork Tile

Seal all cork tile with water based polyurethane sealant. The number of coats of sealant and cure time between coats shall be in accordance with manufacturer's written instructions for commercial applications.

-- End of Section --

SECTION 06415

CUSTOM CASEWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI A161.2	(1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure
ANSI A208.1	(1999) Particleboard Mat Formed Woods
ANSI A208.2	(2002) Medium Density Fiberboard (MDF)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1037	(1999) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM E 1333	(2002) Test for Determining Formaldehyde Concentrations in Air and Emission Roles for Wood Products

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI QS	(2003) Architectural Woodwork Institute Quality Standards.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9	(2003) Cabinet Hardware

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(2002) High Pressure Decorative Laminates
NEMA LD 3.1	(1995) Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1-A. (1997) Architectural Wood Flush Doors

U.S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 GENERAL DESCRIPTION

Work in this section includes custom wood casework as shown on the drawings and as described in this specification. Casework under this section shall provide a finished wood surface of wood veneer or fiber panel as indicated. This Section includes high-pressure laminate surfacing for countertops and interior casework surfaces and cabinet hardware. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish consisting of 3 coats of low VOC polyurethane. Lightly sand between coats. Wood finish may be shop finished or field applied in accordance with Section 09900 PAINTS AND COATINGS.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-02 Shop Drawings

Shop Drawings; G
Installation;

Shop drawings showing all fabricated casework items (such as cabinets, shelving, window seat, wardrobe, and countertops) in plan view, elevations and cross-sections to accurately indicate materials and hardware used, details of construction, dimensions, methods of fastening, installation methods proposed, and a schedule of finishes. Shop drawing casework items shall be clearly cross-referenced to casework items located on the project

drawings. Shop drawings shall include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include finish material manufacturer, pattern, and color.

SD-03 Product Data

Wood Materials; G
Wood Finishes; G
Custom Wood; G
Finish Schedule; G

Descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Quality Standards for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes recycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

SD-04 Samples

Plastic Laminates; G

Samples of each plastic laminate pattern and color. Samples shall be a minimum of 120 by 170 mm in size.

Cabinet Hardware; G

Sample of each cabinet hardware item specified to include hinges, pulls, drawer glides, locks, and shelf supports.

Solid Hardwood, with or for Transparent Finish; G

Agrifiber Board Veneer Panel Products with or for Transparent Finish; G

Sample shall be a minimum 300 x 300 mm in size.

Stain/Color/Finish Samples on Veneer to Be Used; G

Sample shall be a minimum 300 x 300 mm in size

SD-07 Certificates

Quality Assurance; G
Certified Wood; G

A quality control statement which illustrates compliance with and understanding of AWI Quality Standards requirements, in general, and the specific AWI Quality Standards requirements provided in this specification. The quality control statement shall also certify a minimum of ten years manufacturer's experience in custom wood casework fabrication and installation. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

For all wood products incorporated as "certified wood" provide evidence of compliance with Forest Stewardship Council (FSC) standards for certified wood. Evidence shall consist of suppliers invoices with certified products indicated on a line item basis.

SD-12 LEED Documentation

Recycled Content; G
Rapidly Renewable Materials; G
Manufacturing Plant Location; G
Agrifiber Harvesting Location; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, manufacturer's statement of material's rapidly renewable content, location of the manufacturing plant where panel products were produced, and location of harvested agrifiber used in panel products in accordance with LEED-NC RG.

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for wood and agrifiber products.

1.5 QUALITY ASSURANCE

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the Custom Grade quality standards as outlined in AWI Quality Standards. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Contractor must demonstrate knowledge and understanding of AWI Quality Standards requirements for the quality grade indicated.

1.6 MOCK-UP

Prior to final approval of shop drawings, a full-size mock-up shall be provided of a typical floor cabinet and a kitchen shelf unit. The cabinet mock-up shall include all components and hardware necessary to illustrate a completed unit and shall include a minimum of one door and one drawer

assembly. The kitchen shelf mockup shall iclude all components necessary to illustrate a completed unit. The completed mock-ups shall include countertops and back splashes where specified. The mock-ups shall utilize specified finishes in the patterns and colors as indicated on the drawings. Exterior face frame widths of both mockups shall be identical and match per the drawings. Upon disapproval, the Contractor shall rework or remake the mock-up until approval is secured. Rejected units shall be removed from the job site. Approved mock-ups may remain as part of the finished work.

1.7 DELIVERY AND STORAGE

Casework may be delivered knockdown or fully assembled. All units shall be delivered to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity. Protect casework from moisture damage according to the requirements of AWI QS, Section 1700.

1.8 SEQUENCING AND SCHEDULING

Work shall be coordinated with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

1.9 PROJECT/SITE CONDITIONS

Field measurements shall be verified as indicated in the shop drawings before fabrication.

1.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of casework with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades and dimensions to be verified.

(4) Mock-ups are built and provided with all features indicated and specified.

(5) Locations of removable panels are coordinated with required access for mechanical and electrical equipment or fixtures.

(6) Coordinate locations of all electrical and mechanical items to avoid conflicts with casework.

(7) Protection of all casework until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

Framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Face frame front, where indicated on the drawings, shall be kiln-dried Grade II, nominal 19 mm white maple.

2.1.1.1 Standing and Running Trim

Standing or running trim casework components which are specified to receive a transparent finish shall be solid White Maple, plain sawn, Grade II as indicated on drawings. AWI grade shall be custom. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Framing Panels

Framing panels shall be Medium Density Fiberboard that consists of a minimum 90% wheat fiber, straw fiber, grass fiber, sugar cane fiber, bamboo, soy, and/or seed hull byproduct for the cellulosic content of the panel. Medium Density Fiberboard shall not contain urea formaldehyde resins. Medium Density Fiberboard shall meet the minimum standards listed in ANSI A208.1 and ASTM E 1333. Nominal thickness of framing panels shall be as indicated in this specification and on the drawings.

Example Manufacturers:
Dow Industries, WoodStalk Machinable Fiberboard MR (wheat fiber)
Meadowood Industries, MeadowBoard (Oregon ryegrass)
Phenix Biocomposites, Dakota Burl and BioFiber Wheat (straw and sunflower seeds)

2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density (640 to 800 kg per cubic meter, 19 mm thick). A moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 shall be used as the substrate for plastic laminate covered components as located on the drawings and other areas subjected to moisture. Particleboard shall have a minimum 90% wheat fiber, straw fiber, grass fiber, sugar cane fiber, bamboo, soy, and/or seed hull byproduct for the cellulosic content of the panel. Particleboard shall not contain urea formaldehyde resins. Particleboard shall meet the minimum standards listed in ASTM D 1037, ANSI A208.1, and ASTM E 1333.

Example Manufacturers:
Acadia Board Company, DuraCane (sugar cane fiber)
Dow Industries, Isoboard (straw fiber)
Panel Source, PureKor line of Agriboard (wheat fiber)
Phenix Biocomposites, MicroStrand (wheat fiber)
Prime board, Wheatboard (straw fiber)

2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. MDF shall have a minimum 90% wheat fiber, straw fiber, grass fiber, sugar cane fiber, bamboo, soy, and/or seed hull byproduct for the cellulosic content of the panel. Medium Density Fiberboard shall not contain urea formaldehyde resins. Medium Density Fiberboard shall meet the minimum standards listed in ANSI A208.2 and ASTM E 1333.

Example Manufacturers:
Dow Industries, WoodStalk Machinable Fiberboard MR (wheat fiber)
Meadowood Industries, MeadowBoard (Oregon ryegrass)
Phenix Biocomposites, Dakota Burl and BioFiber Wheat (wheat fiber)
WheatSheet (wheat fiber)

2.1.3 Veneer Panels

Veneer panels intended to be exposed to view shall be Medium Density Fiberboard that consists of a minimum 90% wheat fiber, straw fiber, grass fiber, sugar cane fiber, bamboo, soy, and/or seed hull byproduct for the cellulosic content of the panel. Only MDF products specifically recommended by the manufacturer for use in finish casework shall be used. Medium Density Fiberboard shall not contain urea formaldehyde resins. Medium Density Fiberboard shall meet the minimum standards listed in ANSI A208.1 and ASTM E 1333. Nominal thickness of framing panels shall be as indicated in this specification and on the drawings.

Example Manufacturers:
Meadowood Industries, MeadowBoard (Oregon ryegrass)
Phenix Biocomposites, Dakota Burl (straw and sunflower seeds)

2.1.4 Certified Wood

A minimum of 50 percent of all lumber and panel products provided under this specification shall be certified wood meeting LEED-NC RG standards and certification.

2.2 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.2.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 1.22 mm (plus or minus 0.127 mm) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.2.2 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 1.07 mm (plus or minus 0.127 mm) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.2.3 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.51 mm in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.2.4 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.51 mm. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.3 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) with white/off-white color shall be used for closed casework shelf surfaces and drawer interior surfaces. Open casework, such as shelving, shall have visible panels and shelves fabricated with exposed agrifiber product per the drawings.

2.4 EDGE BANDING

2.4.1 Hardwood Banding

Where indicated, edge banding for casework doors, drawer fronts, and shelves shall be 4 mm white maple meeting the requirements of the AWI QS.

2.5 CABINET HARDWARE

All hardware shall conform to BHMA A156.9, unless otherwise noted, and shall consist of the following components:

2.5.1 Cabinets, Window Seat and Wardrobe

a. Door Hinges: concealed type, stainless steel, self closing, full overlay 110 degree minimum opening, BHMA No. B01602. Where indicated continuous hinges, stainless steel, reversible, 180 degree minimum opening, BHMA No. B01491.

b. Cabinet Pulls: (doors and drawers) brushed nickel or pewter finish, 100 mm by 50 mm

c. Drawer Slide: Side mounted type, BHMA No. B05051 with full extension and a minimum 100 pound load capacity. Slides shall include ball bearing guides, over travel detent, and an integral stop to avoid accidental drawer removal.

d. Adjustable Shelf Support System: Recessed (mortised) metal standards, BHMA No. B04071, finish: zinc. Support clips for the standards shall be open type, BHMA No. B04091 finish: zinc.

2.6 ADHESIVES, CAULKS, AND SEALANTS

2.6.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing. Adhesives shall meet the VOC limits established by the South Coast Air Quality Management District Rule No. 1168.

2.6.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use formula. Adhesives shall withstand a bond test as described in NWWDA I.S. 1-A.

2.6.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations.

2.6.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.6.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture. Sealants used as filler shall meet the Bay Area Resources Board Regulation 8, Rule 51.

2.7 WOOD FINISHES

Paint, stain, varnish and their applications required for casework components shall be as indicated in SECTION 09900: PAINTS AND COATINGS and the drawings. Maximize the use of low VOC products. Color and location shall be as indicated on the drawings.

2.8 ACCESSORIES

2.8.1 Grommets

Grommets shall be plastic material for cutouts with a diameter of 60 mm. Locations shall be as indicated on the drawings.

2.9 FABRICATION

Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI custom grade unless otherwise indicated in this specification. Underside of wall cabinet surface shall be consistent with AWI Qual Stds Type B or C. Cabinet style, in accordance with AWI QS, Section 400-G descriptions, shall be flush overlay and face frame reveal.

2.9.1 Base and Wall Cabinet Case Body

Lumber members, where necessary, shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and minimum thicknesses:

a. Body Members (Ends, Divisions, Bottoms, and Tops): 19 mm panel product or as indicated in drawings.

b. Rails, Toe Kicks, and Cabinet Bases: 19 mm panel product

c. Shelving: 25 mm medium density fiberboard (MDF)

d. Cabinet Backs: 12 mm panel product

e. Drawer Sides, Backs, and Subfronts: 12 mm panel product

f. Drawer Bottoms: 6 mm panel product

g. Door and Drawer Fronts: 19 mm agrifiber board veneer panel product

2.9.1.1 Joinery Method for Case Body Members

Contractor shall select from one of the following methods consistent with AWI Custom Standard for each assembly condition indicated:

a. Tops, Exposed Ends, and Bottoms.

1) Steel "European" assembly screws (37 mm from end, 128 mm on center, fasteners will not be visible on exposed parts).

2) Doweled, glued under pressure (approx. 4 dowels per 300 mm of joint).

3) Stop dado, glued under pressure, and either nailed, stapled or

screwed (fasteners will not be visible on exposed parts).

4) Spline or biscuit, glued under pressure.

b. Exposed End Corner and Face Frame Attachment.

1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

3) Butt joint, glued and finish nailed.

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

1) Full bound, captured in grooves on cabinet sides, top, and bottom.

2) Full overlay, plant-on backs with minimum back thickness of 13 mm and minimum No. 12 plated (no case hardened) screws spaced a minimum 80 mm on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

3) Side bound, captured in groove or rabbets; glued and fastened.

d. Cabinet Backs (Floor Standing Cabinets).

1) Side bound, captured in grooves; glued and fastened to top and bottom.

2) Full overlay, plant-on backs with minimum back thickness of 13 mm and minimum No. 12 plated (no case hardened) screws spaced a minimum 80 mm on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

3) Side bound, placed in rabbets; glued and fastened in rabbets.

e. Wall Anchor Strips shall be required for all cabinets with backs less than 13 mm thick. Strips shall consist of minimum 13 mm thick lumber, minimum 60 mm width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.9.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of minimum 19 mm panel product. Finished height for each cabinet base shall be as indicated on the drawings.

2.9.3 Cabinet Door and Drawer Fronts

All door and drawer front edges shall be surfaced with white maple edgebanding, color and pattern as indicated on the drawings or hardwood banding where indicated.

2.9.4 Drawer Assembly

Drawer components shall consist of a removable drawer front and body front, sides, back, and bottom.

2.9.4.1 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure, or

b. Doweled, glued under pressure.

c. Bottoms shall be set into sides, front, and back, 6 mm deep groove with a minimum 9 mm standing shoulder.

d. Lock shoulder, glued, and pin nailed.

2.9.5 Shelving

All Medium Density Fiberboard (MDF) shelving top and bottom surfaces located in enclosed casework shall be finished with thermoset decorative overlay (melamine). Shelving in open casework shall have no overlay. Shelf edges shall be finished with white maple edge banding, unless indicated otherwise. All agrifiber board veneer panel shelving shall be finished with manufacturer's standard clear finish.

2.9.5.1 Recessed Standards Shelf Support System

For shelves concealed behind opaque doors the support system shall be recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

2.9.6 Laminate Clad Countertops

Laminate countertop substrate shall be constructed of 19 mm panel product. The substrate shall be moisture-resistant where countertops receive sinks, lavatories, or are subjected to liquids. All substrates shall have sink cutout edges sealed with appropriate sealant against moisture. No joints shall occur at any cutouts. A balanced backer sheet is required.

2.9.6.1 Edge Style

Front and exposed side countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be

post formed plastic laminate where plastic laminate is used on the countertop. Laminate edge shall be integral with countertop surface. Shape and profile shall be as indicated on the drawings and to dimensions as indicated on the drawings.

2.9.6.2 Laminate Clad Splashes

Countertop splash substrate shall be 19 mm panel product. Laminate clad backsplash shall be integral with countertop, coved to radius, bull nosed at top, and to dimensions as indicated on the drawings. Side splashes shall be straight profile with bull nosed top and provided loose, to be installed at the time of countertop installation. Back and side splash shall meet at miter joint. Back and side splash laminate pattern and color shall match the adjacent countertop laminate.

2.9.7 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and NEMA LD 3.1, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to NEMA LD 3.1 and ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

a. Base/Wall Cabinet Case Body.
Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: Thermoset Decorative Overlay (melamine).

b. Adjustable Shelving.

1) MDF top and bottom surfaces: Thermoset Decorative Overlay (melamine).

2) All edges: White maple edgebanding as indicated.

c. Fixed Shelving.

1) MDF top and bottom surfaces: Thermoset Decorative Overlay (melamine).

EXCEPTION: Exposed fixed shelving shall be finished agrifiber panel surface.

2) Exposed edges: White maple edgebanding as indicated.

d. Door, Drawer Fronts, Access Panels.

1) Interior (semi-exposed) faces: Thermoset Decorative Overlay (melamine).

EXCEPTION: Interior door surfaces shall be finished agrifiber panel surface.

2) Edges: White maple edgebanding as indicated.

e. Drawer Assembly.

1) All interior surfaces of drawer box: Thermoset Decorative Overlay (melamine).

f. Countertops and Splashes.

1) All exposed and semi-exposed surfaces: HPDL Grade HGP

2.9.7.1 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI QS custom grade requirements.

2.9.8 Finishing

2.9.8.1 Filling

No fasteners shall be exposed on exterior of casework surfaces. All nails, screws, and other fasteners in non-laminated interior cabinet components shall be countersunk and the holes filled with wax or burn-in filler consistent in color with the wood species and/or stain used.

2.9.8.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.9.8.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings this specification and SECTION 09900: PAINTS AND COATINGS. All cabinet reveals shall be finished. All cabinet reveals shall be satin finished.

2.9.8.4 Sealing

Seal all surfaces in contact with masonry, tile, or concrete.

PART 3 EXECUTION

3.1 Examination

Verify adequacy of backing and support framing. Verify mechanical, electrical, and other building components are in place and ready for

casework installation.

3.2 INSTALLATION

Installation shall comply with applicable requirements for AWI QS custom quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.2.1 Anchoring Systems

3.2.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 13 mm thick lumber or panel product hanging strip, minimum 60 mm width; securely attached to the top of the wall side of the cabinet back.

3.2.1.2 Wall

Cabinet and display cases to be wall mounted shall utilize minimum 13 mm lumber or panel product hanging strips, minimum 60 mm width; securely attached to the wall side of the cabinet back, both top and bottom.

3.2.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk.

3.2.2.1 Loose Splashes

Loose side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks. Joint width shall not exceed 2 mm.

3.2.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 5 mm "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.2.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI QS custom grade requirements.

3.2.5 Plumbing Fixtures

Sinks, sink hardware, and other plumbing fixtures shall be installed in locations as indicated on the drawings and in accordance with SECTION 15400: PLUMBING, GENERAL PURPOSE.

3.3 ADJUSTMENT AND CLEANING

Adjust all moving and operating parts. Clean all exterior and interior surfaces.

-- End of Section --

SECTION 06610

FIBER REINFORCED PLASTIC (FRP) FABRICATIONS

PART 1 GENERAL

1.1 SCOPE

The work covered by this section includes FRP components of the entrance porticos including columns, pilasters, and entablature as well as wall mounted cornice trim that continues into lobby areas, and as indicated on the drawings. Work includes all labor, materials, equipment, structural frame components and design coordination with fabricators required to provide complete porticos.

1.2 RELATED SECTIONS

Section 05120 - Structural Steel

Section 05400 - Cold-Formed Steel Framing

Section 05500 - Metal Fabrications: Supplementary supports for large items.

Section 07600 - Sheet Metal Work, General

Section 09900 - Paints and Coatings: Field painting and sealing prior to painting.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(2003) Tensile Properties of Plastics.
ASTM D 648	(2004) Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
ASTM D 790	(2003) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 695	(2002 Rev. A) Standard Test Method for Compressive Properties of Rigid Plastics.
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials.

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LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Detail Drawings showing fabrication and installation shall be submitted. Drawings for FRP components shall include custom profiles and dimensions, layouts for separate FRP pieces, joint locations, and details of FRP attachment to support members. Drawings shall also show layouts of metal support for FRP components including support member size and spacing and attachment details at the portico structural steel frames. Drawings shall note where field measured dimensions are required to be taken, if critical to proper installation.

SD-03 Product Data

Manufacturer's data sheets; G

Manufacturer's data sheets on each product to be used shall be submitted and shall include dimensions, finishes, storage and handling requirements and recommendations, and a complete set of manufacturer installation recommendations.

SD-04 Samples

Finish Surface and Color; G

For each custom finish specified, two samples shall be submitted. Finish Surface and Color samples shall be a minimum 150 mm square and shall represent the specified color, texture and pattern. Samples shall also include a representative example of profile relief similar to that specified.

SD-07 Certificates

Manufacturer Qualifications; G

A certificate of Manufacturer Qualifications shall be submitted demonstrating that the manufacturer has a minimum 5 years of experience manufacturing FRP architectural building components that are of a similar type and scope to the

specified work. The certificate shall be accompanied by a list of not less than three previous projects where the manufacturer's product(s) were installed.

Installer Qualifications; G

A certificate of experience shall be submitted for the FRP installer. The installer shall demonstrate a minimum 2 years of experience installing FRP systems similar to the one specified herein. The certificate shall be accompanied by a list of not less than 3 installer projects using an FRP product similar to the type specified. In lieu of demonstrated experience, the installer may submit proof that he or she is a qualified installer of an approved FRP manufacturer's product. Statement of such qualification shall come directly from the FRP manufacturer.

SD-12 LEED Documentation

Manufacturing Plant Location; G

Location of the manufacturing plant where glass fiber reinforced plastic products were produced in accordance with LEED-NC RG.

1.5 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for glass fiber reinforced plastic products.

1.6 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the job site in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Transport, lift, and handle units with care, avoiding excessive stress and preventing damage; use appropriate equipment. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Store products in manufacturer's unopened packaging until ready for installation. Store units upright and not stacked unless permitted by manufacturer.

1.7 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.8 DESIGN VERIFICATION

Components indicated on the drawing establish the visual appearance sought and conform to the building configuration. The Contractor shall verify that all components provided fit the building's structural elements and entrance geometry. Final assembly shall conform to the visual design

indicated without materially altering profiles, alignments and minimum clearances. All additional structural support, backing, sheathing and flashing shall be provided as required to complete the design.

1.9 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

1.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of the fiber reinforced plastic fabrications with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades and coordinate FRP components with structural sub-framing.

(4) Verification of weathertight construction.

(5) Protection of all surfaces during and after installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 GLASS FIBER REINFORCED PLASTIC (FRP) FABRICATIONS

FRP components shall be a molded surface coat over polyester resin laminate reinforced with glass fiber and structural reinforcing as required. Exposed surfaces of FRP shall incorporate sand aggregates and colorants as required to match the specified finish. Components shall be constructed as single pieces as far as practicable and consistent with the design. For example, the entablature for entry porticos may be fabricated in multiple pieces, but the individual cornice and pediment components shall be fabricated as one element top to bottom broken only by vertical joints between adjoining pieces. Columns may be fabricated in half sections that are joined together during field installation, but the column plinths, bases and capitals shall be a single fabrication for the full height of each component. Columns shall have proportions consistent with the Doric or Tuscan orders as indicated on drawings.

2.1.1 Material Properties

Surface Coat: Ultraviolet inhibited NPG-ISO polyester gel coat, 20 mils (0.5 mm) thick, nominal. Texture on exposed faces shall be smooth.

Resin: Isophthalic polyester resin; with flame spread index less than 25, smoke developed index less than 450, when tested in accordance with ASTM E 84; heat distortion greater than 82 degrees C, when tested in accordance with ASTM D 648.

Glass Fiber: "E" type random chopped fibers.

Glass Content: 15 percent by weight, maximum.

Shell Thickness: 5 mm, minimum for entablature components, 12 mm minimum at columns. Thickness of all components shall be as recommended by manufacturer for application and load.

Surface Burning Characteristics: Flame spread index of less than 25, smoke developed index of less than 450,when tested in accordance with ASTM E 84.

2.1.2 Minimum Structural Performance

Flexural Strength: 138 MPa , when tested in accordance with ASTM D 790.

Modulus of Elasticity: 6200 MPa, when tested in accordance with ASTM D 790.

Tensile Strength: 83 MPa, when tested in accordance with ASTM D 638.

Compressive Strength: 117 MPa, when tested in accordance with ASTM D 695.

Bearing Strength: 62 MPa, when tested in accordance with ASTM D 638.

Thermal Expansion Coefficient: 5.56 x 10^-6 per degree C.

Specific Gravity: 1.5.

2.1.3 Fabrication and Erection Tolerances

Variation in Thickness From Nominal: Minus 1.5 mm, plus 6 mm.

Variation in Thickness of Gel Coat: Plus and minus 2.5 mils (0.06 mm), maximum.

Variation from Dimensions Indicated on Drawings: Plus and minus 3 mm, maximum.

Variation from Square: Plus and minus 3 mm, maximum.

Variation of Hardware From Intended Location: Plus and minus 6 mm, maximum.

2.1.4 Manufacturing Requirements

All FRP components shall be factory fabricated with embedded anchorage points for a concealed attachment to the structural frame or wall support

indicated. Embedded anchors shall be made of either galvanized or stainless steel and the style, size, gauge and spacing of the anchors shall be as designed by the manufacturer to adequately handle dead load of the panels and imposed live loads. Where necessary to field install embedded anchorage, the manufacturer's methodology for resin attachment shall be followed. Each FRP unit shall be marked with permanent serial number coordinated with shop drawing designators. All components shall be cured and cleaned prior to shipment, and any material that may be toxic to plant or animal life or incompatible with adjacent building materials shall be removed. All erection aids included in fabricated components shall be concealed in finished construction.

2.1.5 Surface Texture and Color

The finished surface texture and color of all FRP components shall be as specified on the drawings and shall be homogeneous throughout all areas of each portico.

2.1.6 Fasteners

Fasteners used to connect concealed metal attachments to structural steel support members shall be either galvanized or stainless steel. Where necessary for field installation, fasteners used through exposed surfaces of FRP components to the stud support behind shall be stainless steel. All fasteners shall be of a style and size as recommended by the FRP manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true. Contractor shall verify that substrate preparation is correct and ready for FRP component installation before proceeding. Check field dimensions before beginning installation. If dimensions vary from design dimensions and tolerances for proper installation, prepare amended shop drawings indicating required revisions and resubmit for approval.

3.2 PREPARATION

Attachment surfaces shall be thoroughly cleaned prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Install all supplementary temporary and permanent supports as required for proper installation.

3.3 INSTALLATION

3.3.1 General

Install in accordance with applicable building code and manufacturer's recommendations, plumb and true to line; shim where necessary. Install with variation from position shown on drawings not more than 6 mm in 3 m; align

horizontal and vertical joints. Fasten using methods that allow for thermal expansion and contraction. Provide control joints at not more than 10.5 m on center if not indicated on drawings. Provide expansion joints where moving joints in substrate occur.

3.3.2 Field Repair of Seams

All fabrication seams that are not expansion joints, such as seams between column halves and any vertical seams between adjoining cornice and pediment castings, shall be field repaired utilizing the manufacturer's recommended procedures. Seams shall be blended and finished to adjacent finished FRP surfaces such that they are imperceptible from a viewing distance of 1.2 meters. The Contractor shall ensure that the sand aggregates, colorants, and any other component used in patching seams are an exact match to those used in fabrication of the FRP panels. Any field-applied fasteners that are exposed to view shall be countersunk and patched utilizing the seam repair methodology.

3.4 PROTECTION

Protect installed products until completion of project. Provide padded guards at all areas subject to contact from pedestrians or equipment. Touch-up, repair or replace damaged products as determined by contracting Officer.

-- End of Section --

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SECTION 06650

SOLID POLYMER (SOLID SURFACING) FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1999) Installation of Ceramic Tile; including A108.1A-C, 108.4-.13, 118.1-.10, A136.1
ANSI Z124.3	(1995) Plastic Lavatories
ANSI Z124.6	(1997) Plastic Sinks

ASTM INTERNATIONAL (ASTM)

ASTM D 2583	(1995; R 2001e1) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 570	(1998) Water Absorption of Plastics
ASTM D 638	(2003) Tensile Properties of Plastics
ASTM D 696	(2003) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM G 21	(1996; R 2002) Determining Resistance of Synthetic Polymeric Materials to Fungi

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(2002) High-Pressure Decorative Laminates

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LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 GENERAL DESCRIPTION

Work in this section includes areas of wall cladding, countertops, window stools (sills) and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G
Installation; G

Shop Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

SD-03 Product Data

Solid polymer material
Qualifications
Fabrications

Product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

SD-04 Samples

Material; G

A minimum 100 by 100 mm sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

Countertops; G

A minimum 300 mm wide by 150 mm deep, full size sample for each type of counter top shown on the project drawings. The sample

shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

SD-06 Test Reports

Solid polymer material

Test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

SD-07 Certificates

Fabrications
Qualifications

Solid polymer manufacturer's certification attesting to fabricator qualification approval.

SD-10 Operation and Maintenance Data

Clean-up

Maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided,if available. Maintenance kit for matte finishes shall be submitted.

SD-12 LEED Documentation

Manufacturing Plant Location; G

Location of the manufacturing plant where solid polymer products were produced in accordance with LEED-NC RG.

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for solid polymer products.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall not be delivered to project site until areas are ready for installation. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Protective coverings shall be provided to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat, shall be provided. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

1.7 QUALIFICATIONS

To insure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. All fabrications shall be marked with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

1.8 MOCK-UP

The Contractor shall submit Shop Drawings as specified in the Submittals paragraph, under SD-02. Prior to final approval of shop drawings, a full-size mock-up shall be provided of a typical countertop where multiple units are required. The mock-up shall include all solid polymer components required to provide a completed unit. The mock-up shall utilize finishes in patterns and colors indicated on the drawings. Should the mock-up not be approved, the Contractor shall re-work or remake it until approval is secured. Rejected units shall be removed from the jobsite. Approved mock-up may remain as part of the finished work.

1.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of solid polymer fabrications with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Installation at wet areas provides a complete water tight seal.

(5) All finishes and colors are as indicated.

(6) Installed materials are protected from damage.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIAL

Solid polymer material shall be a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting ANSI Z124.3 and ANSI Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.25 mm shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 6 mm in thickness.

2.1.1 Cast,100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	422 kg/cm^2 (min.)	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.0000386cm/cm/degC	ASTM D 696
Boiling water Surface Resistance	No Change	NEMA LD 3-3.05
High Temperature Resistance	No Change	NEMA LD 3-3.06
Impact Resistance (Ball drop)		NEMA LD 3-303
6.4 mm sheet	910 mm, 227 g ball, no failure	
12.7 mm sheet	3550 mm, 227 g ball, no failure	
19 mm sheet	5070 mm, 227 g ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Flame Spread	25 max.	
Smoke Developed	30 max	

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte (gloss rating of 5-20), semigloss (gloss rating of 25-50), and polished (gloss rating of 55-80) as indicated on the drawings.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting ANSI A108.1, Underwriter's Laboratories (UL) listed. This adhesive shall be used to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and UL listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Sealant shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 0.1 mm thick, applied around the edges of cut outs containing hot or cold appliances.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to the greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and manufacturer's requirements. Factory cutouts shall be provided for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected.

2.3.1 Joints and Seams

Joints and seams shall be formed between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Countertop Splashes

Backsplashes and end splashes shall be fabricated from 13 mm thick solid surfacing material and shall be 100 mm high or as indicated on the drawings. Backsplashes and end splashes shall be provided for counter tops and vanity tops at locations indicated on the drawings. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Window stools shall be fabricated from 13 mm thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.5 Countertops

All solid surfacing, solid polymer counter top components shall be fabricated from 13 mm thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall

be complete with 100 mm high permanently attached, 90 degree transition backsplash and loose endsplashes where indicated on the drawings. Attach 50 mm wide reinforcing strip of polymer material under each horizontal counter top seam.

2.3.5.1 Countertop With Sink

Countertops with stainless steel or vitreous china sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 15400 PLUMBING,GENERAL PURPOSE.

2.3.6 Wall Cladding/Wainscoting

Solid polymer wall cladding or wainscoting shall be provided to dimensions and in locations as shown on the drawings. Panels shall be fabricated from manufacturer's standard 6 mm thick sheet product. Panels shall be provided to heights shown on the drawings with no horizontal seaming. Panels shall utilize the maximum panel dimension available to minimize vertical seams.

2.3.7 Surface Finish

Finished surfaces shall be uniform in character and free of surface distortion, pits, cracks, crazing or abrasions. Finish of components shall be as follows:

Countertops	Polished finish with a gloss range of 50-80
Wall Cladding	Matte finish with a gloss range of 5-20
Cladding Trim	Semi-gloss finish with a gloss range of 20-50
Window Stools	Polished finish with a gloss range of 50-80

2.3.8 Thermoforming

Thermoforming shall comply with manufacturer's product data. Molds shall be constructed of plywood in "male/female" sections matching component shapes. Component parts shall be shaped prior to joining and finishing. Pieces shall be cut to finished dimensions with edges sanded and nicks and scratches removed. Heat the entire component uniformly between 275-325 degrees Fahrenheit during forming. Prevent blistering, whitening and cracking of solid polymer material during forming. Defective material shall be rejected.

2.3.9 Surface Inlays

Color inlay shall comply with manufacturer's product data. Groove for inlay shall be routed to straight edge or pattern indicated on the Drawings with groove completely filled to overflowing, without air bubbles or voids, using bulk acrylic material furnished by polymer manufacturer. Inlay shall be sanded, finished, and touched up for uniform appearance.

Material inlay shall comply with manufacturer's product data, using material and finish as shown on the Drawings.

PART 3 EXECUTION

3.1 COORDINATION

In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/ installer and other trades to insure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer. Contractor shall provide appropriate staging areas for solid polymer fabrications.

3.2 INSTALLATION

3.2.1 Components

All components and fabricated units shall be installed plumb, level, and rigid. Field joints between solid polymer components to provide a monolithic appearance shall be made using solid polymer manufacturer's approved seam adhesives, with joints inconspicuous in the finished work. Metal or vitreous china sinks and lavatory bowls shall be attached to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Tub/shower surrounds shall be constructed and installed in full compliance with the manufacturer's written instructions for wet wall systems. Where tub/shower surround abuts the bath tub use care to verify that silicone sealant seam is installed full depth, with a solid, smooth coved surface to ensure positive drainage and eliminate potential wicking of water between the surface sheet and the substrate. Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

3.2.1.1 Loose Counter Top Splashes

Loose splashes shall be mounted in locations as noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Adhesion of particulate patterned solid polymer splashes to counter tops shall utilize a clear silicone sealant.

3.2.1.2 Wall Panels & Panel Systems

Installation of wall panels and system components to substrates shall include the use of a neoprene-based panel adhesive. Seam adhesive shall be used to adhere all solid polymer components to each other with the exception of expansion joints and inside corners. All inside corners and expansion joints between solid polymer components shall be joined with silicone sealant. All joints between solid polymer components and

non-solid polymer surfaces shall be sealed with a clear silicone sealant.

3.2.2 Silicone Sealant

A clear, silicone sealant or caulk shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.2.3 Plumbing

Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400.

3.3 SURFACE FINISH

Final surface finishing of all solid polymer materials shall be as indicated in writing by the manufacturer. Surfaces shall be orbital sanded using appropriate sanding film for the designated finish. Buff all surfaces following standing and wipe clean. Utilize compounding and/or finishing liquids as indicated for final surface preparation.

3.4 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. The Contractor shall submit maintenance data as specified in the Submittals paragraph, under SD-10.

-- End of Section --

SECTION 07110

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1187	(1997; R 2002e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D 1227	(1995; R 2000) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4479	(2000) Asphalt Roof Coatings - Asbestos Free

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Materials

Certificates attesting that the materials meet the requirements specified.

SD-12 LEED Documentation

Manufacturing Plant Location; G

Location of the manufacturing plant where bituminous dampproofing products were produced in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for bituminous dampproofing products.

1.4 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.5 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup; and therefore, shall not be used to cover dampproofing materials. Care shall be taken during storage to avoid separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

1.6 SURFACES

Dampproofing shall be applied to below grade exterior surfaces of foundation walls, exterior (cavity) faces of concrete or masonry walls providing structural backup to brick veneer, and other locations indicated. Dampproofed surfaces shall not be visible in finished construction.

1.7 SCHEDULING

Dampproofing of foundation walls shall be scheduled so that curing will be accomplished prior to backfilling and so that backfilling will be accomplished as soon as possible after curing.

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance bituminous dampproofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against

approved material data.

(3) Protection of adjacent surfaces from contamination with dampproofing products.

(4) Limitation of dampproofing application to only those surfaces concealed from view in finished construction.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 EMULSION-BASED ASPHALT DAMPPROOFING

2.1.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1227 Type IV, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

2.1.2 Non-Fibrated Emulsion-Based Asphalt

Non-fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1187 Type II or ASTM D 1227 Type III, manufactured of refined asphalt, emulsifiers and selected clay. Asphalt shall contain a minimum 58 percent solids by weight, 55 percent solids by volume.

2.2 SOLVENT-BASED ASPHALT DAMPPROOFING

2.2.1 Asphaltic Primer

Primer for cold-applied solvent-based asphalt dampproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

2.2.2 Fibrated Asphalt

Fibrated solvent-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 4479 Type I, asbestos-free, manufactured with selected asphalts, stabilizers, mineral spirits and fibrated with mineral fibers. Solvent-based asphalt shall contain 72 percent solids by weight, 65 percent solids by volume.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous dampproofing shall be prepared in

accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

Dampproofing shall be applied after the priming coat is dry, but prior to deterioration of the primed surface. Apply two coats of dampproofing. The initial coat shall be applied by brush to form complete bond with primer. Second coat shall be applied with brush or sprayed. Recoat all porous spots.

3.2.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 0.3 mm thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.2 L/square meter, cold-applied.

b. Fibrated Dampproofing: 0.8 L/square meter, cold-applied with spray, brush or trowel.

c. Non-fibrated Dampproofing: 0.8 L/square meter, cold-applied with

spray, brush or trowel.

3.2.2 Solvent-Based Asphalt

Solvent-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film not less than 0.3 mm thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.4 L/square meter, cold-applied.

b. Dampproofing Coat: 0.8 L/square meter, cold-applied with spray, brush or trowel.

3.3 CLEAN-UP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

3.4 PROTECTION

The completed dampproofing work shall be protected from damage during and after construction.

-- End of Section --

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SECTION 07131

ELASTOMERIC SHEET WATERPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1004	(2003) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1149	(1999) Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D 1204	(2002) Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D 146	(1997e1) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D 2136	(2002) Coated Fabrics - Low-Temperature Bend Test
ASTM D 2240	(2003) Rubber Property - Durometer Hardness
ASTM D 297	(1993; R 2002e1) Rubber Products - Chemical Analysis
ASTM D 3045	(1992; R 2003) Practice for Heat Aging of Plastics Without Load
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 429	(2002a) Rubber Property-Adhesion to Rigid Substrates
ASTM D 471	(1998e1) Rubber Property - Effect of Liquids

ASTM D 5385	(1993; R 2000e1) Hydrostatic Pressure Resistance of Waterproofing Membranes
ASTM D 570	(1998) Water Absorption of Plastics
ASTM D 573	(1999) Rubber - Deterioration in an Air Oven
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 638	(2003) Tensile Properties of Plastics
ASTM D 746	(1998e1) Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 751	(2000) Coated Fabrics
ASTM D 903	(1998) Peel or Stripping Strength of Adhesive Bonds
ASTM E 154	(1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

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LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Elastomeric waterproofing sheet material G,

Protection board

Primers, adhesives, and mastics

SD-04 Samples

Corner and field condition

SD-06 Test Reports

Elastomeric waterproofing sheet material

Certify compliance with performance requirements specified herein.

SD-08 Manufacturer's Instructions

Submit Manufacturer's material safety data sheets for primers, adhesives and mastics.

SD-12 LEED Documentation

Manufacturing Plant Location; G

Location of the manufacturing plant where elastomeric sheet waterproofing products were produced in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for elastomeric sheet waterproofing products.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Include description and physical properties; termination details; application details; recommendations regarding shelf life, application procedures; requirements for protective covering; and precautions for flammability and toxicity.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver and store materials out of the weather, in manufacturer's original packaging with brand name and product identification clearly marked. Do not permit uncertified materials in the work area. Storage temperature for adhesives shall be between 16 and 27 degrees C. Protection board shall be stored flat and off the ground.

1.6 SURFACES

Elastomeric sheet waterproofing shall be applied to electrical and plumbing vault walls and other surfaces as indicated. Waterproofing shall not be visible above grade in finished construction.

1.7 ENVIRONMENTAL CONDITIONS

Do not apply waterproofing during inclement weather or when there is ice, frost, surface moisture, or visible dampness on the surface to receive waterproofing and when ambient and surface temperatures are 4 degrees C or

below.

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of elastomeric membrane waterproofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Coordination of membrane installation following completion of all work that penetrates the membrane.

(4) Verification of waterproof assembly with leakage tests.

(5) Protection of membrane from other construction activity following completion.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Provide one of the types of elastomeric waterproofing sheet material and related primers, adhesives, and mastics as specified herein. Ensure compatibility of waterproofing materials within a specific type, with each other, and with the materials on which they will be applied. Materials shall conform to the applicable performance requirements cited below when tested in accordance with the referenced ASTM publications.

2.2 BUTYL RUBBER SHEETING

Not less than 1.5 mm minimum thickness.

2.2.1 Butyl Rubber Sheeting Performance Requirements

a. Thickness Tolerance, ASTM D 412: Plus or minus 10 percent;

b. Specific Gravity, ASTM D 297: 1.20, plus or minus 0.05;

c. Tensile Strength, ASTM D 412: 7.7 MPa minimum;

d. Tensile Stress at 300 percent elongation, ASTM D 412: 3.85 MPa minimum;

e. Elongation, ASTM D 412: 300 percent minimum;

f. Tear Resistance, Die C, ASTM D 624: 26.3 newtons per millimeter (N/mm)minimum;

g. Shore A Hardness, ASTM D 2240: Five-second interval before reading; 60 plus or minus 10;

h. Ozone Resistance, ASTM D 1149: No cracks, 7 days - 50 pphm - 37.8 degrees C, 20 percent elongation;

i. Heating Aging-Accelerated, ASTM D 573: Tensile retention, 60 percent of minimum original elongation retention; 60 percent of minimum original requirement; 7 days, 115.6 degrees C;

j. Butyl Identification, ASTM D 471, Tricresyl Phosphate Immersion: Maximum volume swell 10 percent, 70 hrs, 100 degrees C;

k. Low Temperature Flexibility, ASTM D 746: No failure at -40 degrees C ;

l. Water Absorption, ASTM D 471: +1 percent maximum. 7 days, 70 degrees C;

m. Exposure to Fungi and Bacteria in Soil, ASTM E 154, Minimum 16 Weeks: Unaffected; and

n. Water Vapor Transmission, 26.7 Degrees CPermeance, ASTM E 96, Procedure B or BW: 8.58 x 10-7 g/Pa.s.m2 maximum.

2.2.2 Adhesive, Cement, and Tape for Use with Butyl Rubber

As recommended by the butyl rubber waterproofing membrane manufacturer.

2.3 THERMOPLASTIC MEMBRANE: POLYVINYL CHLORIDE (PVC)

Polyvinyl chloride (PVC) flexible sheets with non-woven fiberglass reinforcing not less than 1.5 mm minimum thickness.

2.3.1 Thermoplastic Membrane Performance Requirements

a. Overall thickness, ASTM D 751:, 1.50 mm min.;

b. Tensile strength ASTM D 638:, 11.03 MPa, min.;

c. Elongation at break, ASTM D 638:, 250 percent minimum;

d. Seam strength, ASTM D 638:, 90 percent minimum of tensile strength;

e. Retention of properties after heat aging, ASTM D 3045;

f. Tensile strength, ASTM D 638:, 95 percent of original;

g. Elongation, ASTM D 638:, 95 percent of original;

h. Tear resistance, ASTM D 1004:, 7.7 Kilogram Force;,

i. Low Temperature Bend , ASTM D 2136:, -40 C;

j. Liner Dimensional Change, ASTM D 1204: 0.002 percent; and

k. Weight Change After Immersion in Water, ASTM D 570:, 2.0 percent maximum.

2.3.2 Adhesives

a. Adhesive for thermoplastic flashings as recommended by manufacturer.

b. Adhesive for Sub-Membrane Grid: 100% solids, two-part urethane, with minimum tensile strength of 1.04 MPa, , in accordance with ASTM D 412 and adhesion to concrete of 12 ply in accordance with ASTM D 429 as recommended by manufacture.

2.3.3 Accessories

a. Securement Strip: 14 gauge stainless steel metal bar, 2.54 cm wide, pre-punched 2.54 cm on center for securement.

2.4 COMPOSITE, SELF-ADHERING MEMBRANE SHEETING

Cold applied composite sheet consisting of rubberized asphalt and cross laminated, high density polyethylene film. Not less than 1.5 mm minimum thickness is required.

2.4.1 Composite, Self-Adhering Sheeting Performance Requirements

a. Tensile Strength, ASTM D 412, Die C: 1.6 MPa minimum;

b. Ultimate Elongation, ASTM D 412, Die C: 200 percent minimum;

c. Water Vapor Transmission,ASTM E 96 26.7 Degrees CPermeance, Procedure B: 5.72 x 10-7 g/Pa.s.m2 maximum;

d. Pliability Degrees F, ASTM D 146: (180 Degrees Bend Over 25 mm Mandrel): No cracks at minus -32 degrees C;

e. Cycling Over Crack at Minus -26 degrees C: Membrane is applied and rolled across two primed concrete blocks with no separation between blocks. Crack opened and closed from zero to 6 mm. No effect at 100 cycles;

f. Puncture Resistance, ASTM E 154: 18 kg minimum;

g. Lap Adhesion at Minimum Application Temperature, ASTM D1876 Modified, 880 N/m (5 lbs/in.);

h. Peel Strength, ASTM D 903: Modified, 1576 N/m, ;

i. Resistance to Hydrostatic Head, ASTM D 5385:, 70 m, of water

j. Water Absorption, ASTM D 570; 0.1% maximum.

2.4.2 Primer

Asphalt composition, ASTM D 41, or synthetic polymer in solvent as recommended by the membrane manufacturer.

2.4.3 Mastic

Polymer modified asphalt in suitable solvent of trowel-grade consistency and as recommended by the membrane manufacturer.

2.5 Protection Board

Provide protection board that is compatible with the waterproofing membrane. Use a minimum 13 mm thick fir bituminous - impregnated board, 25 mm for polystyrene, 3 mm thick for vertical and 6 mm for horizontal premolded bituminous protection board as recommended by the manufacturer

2.6 ACCESSORIES

Flashing, counterflashing, expansion joint covers and corner fillets shall be as recommended by the membrane manufacturer.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Before starting the work, verify that surfaces to be waterproofed are in satisfactory condition. Notify the Contracting Officer of defects or conditions that will prevent a satisfactory application. Do not start application until defects and conditions have been corrected.

3.2 SURFACE PREPARATION

Ensure surfaces to be treated are clean, dry, smooth, and free from deleterious materials and projections. Thoroughly wet holes, joints, cracks, and voids in masonryand concrete with water and fill with Portland cement mortar, strike flush, and permit to dry. Cut off high spots or grind smooth. Finish top surfaces of projecting masonry or concrete ledges below grade, except footings, to a steep bevel with Portland cement mortar. Sweep surfaces to be covered before applying waterproofing to remove dust and foreign matter. Cure concrete by a method compatible with the waterproofing system.

3.3 APPLICATION

Follow manufacturer's printed installation instructions. Where indicated, mop continuous cant strips in place at vertical and horizontal corners before installing the waterproofing membrane. Do not use untreated wood or wood fiber cants. When using solvent welding liquid, avoid prolonged contact with skin and breathing of vapor. Provide adequate ventilation.

Carry waterproofing of horizontal surfaces up abutting vertical surfaces as indicated and adhere solid to the substrate. Avoid wrinkles and buckles in applying membrane and joint reinforcement.

a. Non-Self-Adhering Membrane: Unroll membrane and allow to remain flat for at least one-half hour before application. Apply an asphalt concrete primer prior to application of asphaltic adhesive. Where solvent adhesive is applied, allow major portion of solvent to evaporate so that bonding adhesive does not stick to a dry finger touching it. Apply elastomeric waterproofing membrane in a full bed of adhesive at a uniform coverage rate in accordance with the recommendations in the membrane manufacturer's printed instructions. Pull membrane tight without stretching. As soon as adhesive is fully set and dry, recheck lap splices. Where openings or fishmouths appear, reseal and reroll lap splices.

b. Self-Adhering Membrane: Apply composite, self-adhering membrane on surfaces primed at a uniform coverage rate in accordance with membrane manufacturer's printed instructions. Remove release sheet and apply with tacky surface in contact with dried primer.

c. Protection: Protect membrane over horizontal surfaces from abnormal traffic during installation. Use only equipment with rubber tires. Provide walkway protection where heavy traffic from other trades is expected. Do not store material on membrane.

3.3.1 Butyl Rubber

Lap sheets at sides and ends a minimum of 150 mm over the preceding sheet. Apply lap splicing cement over entire 150 mm splice area prior to application of sealant. Sealant shall be continuous along the entire length of the splice. Maintain a continuous bead of sealant at all membrane splices or as required by the manufacturer. When membrane will be below water table, provide a tongue and groove cemented splice a minimum of 150 mm with factory made heat vulcanized seam not less than 50 mm or as required by the manufacturer.

3.3.2 Thermoplastic Membrane (PVC)

Deck shall be clean, smooth and dry without surface irregularities. Consult with membrane manufacturer prior to grid application. Install 300 mm wide sub-membrane containment grid as required by manufacturer. Provide and install the containment grid at intervals across the width and length of the substrate, at the base of all transitions, walls, curbs, penetrations, and at the perimeter of each deck/substrate section. Fully adhere strips to the deck in a full bedding of two-part urethane adhesive medium. Adjacent sheets shall be welded in accordance with manufacturer's instructions. All side and end lap joints shall be hot-air welded. Lap area shall be a minimum of 75 mm wide when machine welding, and a minimum of 100 mm wide when hand welding but not less than recommended by the manufacturer. Overlaps shall be with the flow of water.

3.4 Composite, Self-Adhering Membrane

Lap sheets at edges and ends a minimum of 65 mm over the preceding sheet. All side laps shall be minimum 65 mm and end laps shall be minimum 127 mm. Laps shall be self adhesive, mastic as per manufacturer's recommendation. Roll or firmly press to adhere membrane to substrate. Cover corners and joints with two layers of reinforcement by first applying a 300 mm width of membrane centered along the axis. Flash drains and projections with a second ply of membrane for a distance of 150 mm from the drain or projection. Finish exposed, terminated edges of membrane on horizontal or vertical surfaces with a toweled bead of mastic. Apply mastic around edges of membrane, and drains and projections. Apply mastic at end of each work day.

3.5 FLASHING

Flash penetrations through membrane. Ensure that where reinforcing bars penetrate a waterproofing membrane, each of those penetrations be sealed with the appropriate sealant or mastic flashing component. Embed elastomeric membrane in a heavy coat of adhesive, except for self-adhering membrane. Continuous metal reglets shall be installed, horizontally on footing and vertically on intersecting and connecting walls, and as specified in Section 07600 FLASHING AND SHEET METAL. Metal reglets shall receive exposed edges of membrane waterproofing. Secure membrane into reglets by lead wedges and fill with cement as recommended by manufacturer of waterproofing materials. Counterflash upper edge of membrane waterproofing and protective covering as specified in Section 07600 FLASHING AND SHEET METAL.

3.6 FIELD QUALITY CONTROL

Notify the Contracting Officer one day prior to date of performing tests. Before concealment, cover elastomeric waterproofing on horizontal surfaces over finished spaces with 100 mm of ponded water for 24 hours. Do not add water after start of 24 hour period. Carefully measure water level at beginning and end of 24 hour period. If water level falls, remove water and inspect waterproofing membrane. Make repairs or replacement as directed, and repeat test. Do not proceed with work that conceals membrane waterproofing before receiving approval and acceptance of Contracting Officer.

3.7 PROTECTIVE COVERING

After installation has been inspected and approved by the Contracting Officer, apply a protective covering to the membrane waterproofing prior to backfilling. Protect vertical membrane waterproofing with a 13 mm minimum thickness of asphalt plank; 13 mmminimum thickness of fiberboard; or 3 mm minimum thickness of compatible water-resistant bitumen type protection board with edges abutting adjacent edges and exposed surfaces covered by a taping system recommended by manufacturer of protection board. Cover horizontal membrane waterproofing with similar protection board and Portland cement mortar not less than 20 mm thick; place uniformly and allow to set before installing subsequent construction.

-- End of Section --

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SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 RELATED SECTIONS

Refer to SECTION 04850 NON-BEARING MASONRY VENEER/WOOD STUD WALLS for additional information related to insulation in those exterior wall systems. Refer to SECTION 06100 ROUGH CARPENTRY for information related to insulation in Structural Insulated Panels (SIP) used as roof deck.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 272	(2001) Test Method for Water Absorption of Core Materials for Structural Sandwich Construction
ASTM C 423	(2002a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 518	(2003) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 665	(2002) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 1338	(2000) Test Method for Determining Fungi Resistance of Insulation Materials and Facings
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Damp Proofing, and Waterproofing
ASTM D 312	(2000) Asphalt Used in Roofing
ASTM D 1622	(2003) Test Method for Apparent Density of Rigid Cellular Plastics

ASTM D 2863	(2000) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E 96	(2000e1) Water Vapor Transmission of Materials
ASTM E 136	(2000) Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C
ASTM E 154	(1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E 283	(1991; R 1999) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Differences Across the Specimen.

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LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

SD-03 Product Data

Application of Insulation; G

Insulation manufacturer's recommendations for the application and installation of insulation.

Inspection; G

The inspection procedure for insulation installation, prior to start of building insulation work.

Material Properties; G

Insulation manufacturer's product sheets indicating properties of materials.

SD-07 Certificates

Insulation; G

Certificate attesting that the perlite, glass and mineral fiber, polystyrene, or polyurethane soy foam insulation furnished for the project contains recycled and/or recovered material, and showing a specific percent of recycled and/or recovered material.

Insulation; G

Certificate attesting that the polyurethane soy foam insulation furnished for the project contains a minimum 20% of soybean oil.

SD-12 LEED Documentation

Recycled Content; G

Rapidly Renewable Materials; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, manufacturer's statement of material's rapidly renewable content, location of the manufacturing plant where insulation was produced, and percentage of the insulation's raw materials extracted regionally in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for insulation products.

1.5 STORAGE OF MATERIALS

Insulation materials shall be stored in accordance with manufacturer's instructions. Insulation, vapor barrier and moisture barrier shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation shall not be used and shall be permanently removed from the site. For 24

hours immediately prior to installation, all materials shall be maintained at a temperature above 10 degrees C. Polystyrene insulation shall be stored away from areas where welding is being performed or where contact with open flames is possible.

1.6 FIRE CLASSIFICATION

Insulation used in rated wall or ceiling assemblies shall be mineral wool, have been tested for fire resistive performance and shall be listed as non-combustible, per ASTM E 136. Flame spread rating shall be 5 or less and smoke developed of 0 per ASTM E 84.

1.7 PROJECT CONDITIONS

Verify completion status of all construction adjacent to areas to receive insulation. Do not begin insulation or vapor barrier installation until all work to be concealed is completed. Coordinate work of related trades to ensure proper location of all systems intersecting insulation.

1.8 ENVIRONMENTAL REQUIREMENTS

Polyurethane soy foam spray insulation shall not contain any urea-formaldehyde, nor shall any products or equipment requiring the use of CFC's or HCFC's be permitted either in the product itself or the application process.

1.9 MOCK UP

Prepare a demonstration installation of polyurethane soy foam spray insulation on the masonry wall mock, or on a small (2 square meters) section of exterior wall in one corner of the facility. Mock up shall demonstrate appropriate installation practice and verify adhesion of insulation to substrate materials. Following acceptance by the contracting officer, the mock up shall remain visible for the remainder of the application period to serve as a quality standard. Approved mock up may remain as part of the finished construction.

1.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of building insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

1) Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

2) Storage and handling of materials.

3) Inspection of material delivered to the project site against approved material data.

4) Insulation meets all requirements for shape, size, strength, fire

resistance and acoustic performance, etc.

5) Shop drawings include explicit identification of coordination with other trades.

6) Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

7) Insulation and vapor barriers are protected following installation until protected by finished construction.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 BITUMINOUS MATERIALS

Bituminous materials may be used for attachment of perimeter insulation to inside face of foundation walls. Bituminous materials used as adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions used. Polystyrene insulation shall be faced with insulation manufacturer's recommended separation sheet for asphalt. Bituminous materials shall conform to the following requirements:

2.1.1 Asphalt Bitumen

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

2.1.2 Asphalt Cement

ASTM D 4586, Type I for surfaces sloped from 0 to 250 mm per meter; Type II for slopes greater than 250 mm per meter.

2.1.3 Asphalt Primer

ASTM D 41.

2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value, and the thickness. Identification shall be on individual pieces or individual packages. Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at 24 degrees C in accordance with ASTM C 518. Minimum thickness shall be as recommended by the manufacturer, or as indicated.

The insulation manufacturing process shall not include chlorofluorocarbons

(CFC) or urea formaldehydes. Insulation and fiberboard shall conform to EPA requirements in conformance with SECTION: RECYCLED / RECOVERED MATERIALS. Materials containing more than one percent asbestos will not be allowed. Insulation shall be a combination of the following materials, as specified or indicated on drawings:

2.2.1 Batt or Blanket

2.2.1.1 Glass Fiber Batts and Rolls (Thermal Batts)

Glass fiber batts and rolls shall conform to ASTM C 665, Type I unfaced insulation, Class A , having a UL flame spread rating of 10 and a smoke developed rating of 100 or less when tested in accordance with ASTM E 84. Width and length shall suit construction conditions. Minimum R value of 19.

2.2.1.2 Glass Fiber Batts and Rolls (Sound Attenuation Batts)

Glass fiber batts and rolls shall conform to ASTM C 665, Type I unfaced insulation, and ASTM E 136. Material shall be Class A, having a UL flame spread rating of 10 and a smoke developed rating of 100 or less when tested in accordance with ASTM E 84. Acoustic performance shall test an NRC value of 1.0 minimum for a nominal 90 mm thick batt. Width and length shall suit construction conditions. Thickness as indicated.

Typical Locations: Interior, non-fire rated, stud walls where increased sound control is required.

Suspended ceilings where sound control is indicated.

2.2.1.3 Mineral Wool Batt (Sound Attenuation Fire Batts)

Mineral wool batt shall conform to ASTM C 665, Type I unfaced insulation and shall be non-combustible by ASTM E 136. Material shall be Class A, having a UL flame spread rating of 10 and a smoke developed rating of 100 or less when tested in accordance with ASTM E 84. Acoustic performance shall test a NRC value of 1.0 minimum for a nominal 65 mm thick batt. Width and length shall suit construction conditions. Thickness as indicated.

Typical Locations: Interior, fire rated walls and ceilings.

2.2.1.4 Mineral Wool (Safing Insulation)

Mineral wool batt shall conform to ASTM C 665, Type I unfaced insulation and shall be non-combustible by ASTM E 136. Material shall be Class A, having a UL flame spread rating of 10 and a smoke developed rating of 100 or less when tested in accordance with ASTM E 84. Width and length shall suit construction conditions. Thickness as required.

Typical locations: Voids in elevated concrete floor slabs and at edge of slab and exterior wall construction; gaps, voids and penetrations in fire rated walls.

2.2.2 Sill Sealer

Mineral wool, 25 mm thick and compressible to 0.8 mm, width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I. Provide at exterior walls.

2.2.3 Rigid Insulation (Perimeter Foundation, Exterior Wall Cavity and Below Slab)

Minimum R value of 7. Extent of insulation as indicated on drawings.

2.2.3.1 Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV. Nominal R value of 5 for 25 mm thick section. Maximum water absorption of 0.7 percent by volume when tested according to ASTM C 272.

2.2.4 Polyurethane Soy Foam Spray Insulation (all exterior stud walls)

Polyurethane soy foam spray insulation shall be a combination of soybean oil and semi-open-cell modified polyurethane, conforming to the following standards:

Thermal Resistance: ASTM C 518: 3.6 (R-value per inch)

Air Permeance: ASTM E 283 for 133 mm of material: 0.0049 l/sm/second

Water Vapor Transmission: ASTM E 96 for 127 mm of material: 16 perms.

Sound Transmission Class (STC): ASTM E 90: STC 37 in wood stud wall

Noise Reduction Coefficient (NRC): ASTM C 423: NRC 70 in wood stud wall

Corrosion: No significant corrosion when in contact with steel under 85 percent relative humidity.

Bacterial of Fungal Growth: ASTM C 1338: No growth and no material deterioration.

Flame Spread and Smoke Development Rating: ASTM E 84: flame less than 20 and smoke less than 400.

Fuel Contribution: ASTM E 84: 2.

Oxygen Index: ASTM D 2863: average value of 23.1 percent.

Foam Density: ASTM D 1622: 0.5 lb/cubic ft

Use Restrictions:

Polyurethane soy foam spray insulation shall not be installed below grade, in contact with water or within 50 mm of heat emitting devices where the temperature is in excess of 93 degrees C. Polyurethane soy foam spray insulation is never acceptable as an interior finish and must always be concealed by finished

construction. A separate, continuous vapor retarder shall separate the insulation from all interior spaces.

2.2.4.1 Representative Products and Manufacturers:
1) BioBased Systems: Bio Base 501: Polyfoam 1-800-803-5189
2) BioPolymers, LLC: Healthy Seal 500 1-800-769-3626
3) Soy Foam 1-877-796-3626

2.3 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Thickness shall be 6 mils. Vapor retarder shall have a maximum vapor permeance rating of 29 ng per Pa per second per square meter (0.5 perms) as determined in accordance with ASTM E 96, unless otherwise specified.

2.4 FASTENERS AND RETAINERS

Friction fit thermal batt or blanket insulation between studs and lay-in insulation in concealed ceiling spaces is acceptable. Sound attenuation insulation shall be mechanically fastened to studs. Fasteners and retainers, where required, shall be specifically designed to hold insulation securely in place. Fasteners shall be of the size and type necessary to hold insulation adequately and provide a neat appearance. Metallic components shall be nonferrous or have a corrosion resistant coating. Fasteners and retainers shall not pose a risk of penetration to vapor barriers in exterior walls.

PART 3 EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation shall be coordinated with adjacent construction to ensure that insulation and vapor retarder remains undisturbed once placed. Placement of insulation and vapor retarder shall be closely followed by installation of gypsum wallboard or other wall finish material. All surfaces shall be free from ice, frost and surface moisture and shall be smooth, firm, free from dirt, projections and foreign materials. Vents and other items penetrating the walls shall be secured in position and properly prepared for flashing. Surfaces shall be inspected and approved prior to application of insulation.

3.2 THICKNESS OF INSULATION

Drawings shall not be scaled to determine the required thickness of insulation. Actual installed thickness of insulation shall be such as to provide the R-values indicated. For acoustical insulation the installed thickness shall be as shown. Polyurethane soy foam insulation shall be applied to fill wall cavities completely and finished flush with interior face of studs.

3.3 ENVIRONMENTAL CONDITIONS

The temperature of insulating materials during installation shall be as

required by the manufacturer. Interior air temperature and humidity level shall also be as recommended by insulation manufacturer.

3.4 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. Insulation shall be installed on the exterior side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.5 Perimeter and Below Slab Insulation

Insulation shall be applied in one layer as shown on drawings. Insulation placed directly against foundation walls shall be applied with adhesives as recommended by the manufacturer to hold it in place. When backfilling, care shall be exercised to ensure that the insulation remains in place and is undamaged. Insulation shall be placed to extend continuously from the top of the footing to the bottom of the floor slab. Under slab insulation shall be continuous throughout the building. Coordinate insulation layout with areas of slab recess, mechanical penetrations and installation of reinforcing and radiant floor heating system.

3.6 Batt and Blanket Insulation

Insulation shall be installed between framing members. Insulation shall be placed to the sides of framing members to provide a continuous seal and so that the entire weight of the insulation will be carried by the framing members. Install insulation in voids around door and window frames in insulated walls. Do not compress insulation at interruptions in voids caused by mechanical and electrical components, cut and fit insulation to completely fill voids and irregular areas. Insulation in fire rated walls shall be installed consistent with the practices and materials indicated in the pertinent UL listed design.

3.7 Safing Insulation

Safing insulation shall be installed at the top of fire-rated walls, at openings where cables, ducts, piping or other building components penetrate fire rated walls, or any floor deck, and as indicated on the drawings. Insulation shall be packed in openings leaving no voids. Safing insulation shall be coordinated with requirements for firestopping design requirements.

3.8 Sound Attenuation Insulation

Insulation installed in walls shall be securely fastened to framing members to prevent settling. Ends and edges shall be butted together and all voids shall be filled. Insulation installed over suspended ceilings shall be loose laid. Coordinate additional weight with design/installation of suspended ceiling frame.

3.9 Sill Sealer Insulation

Insulation shall be installed in lengths as long as practicable and in a

manner that will provide a compression by the sill to a dense, uniform, continuous seal.

3.10 Polyurethane Soy Foam Spray Insulation

Verify that all work within areas to receive insulation is complete. Remove all foreign materials that may affect the installation of the insulation. Do not spray in areas where expanding foam will displace materials that are insufficiently secured until such materials are properly secured. Comply with all of manufacturer's written application instructions for preparation and application. Mask and protect all adjacent surfaces and materials to prevent damage and overspray contamination. Apply insulation to achieve a uniform monolithic density free of voids. Fill all voids completely, including areas surrounding windows, doors, equipment and penetrations. Where the proximity of structural members or other components prohibit the introduction of insulation, apply caulking to seal all joints. Trim insulation as necessary to provide a flat surface for the installation of gypsum wallboard or other sheet products. Bowing of wallboard over insulation is not acceptable. In an effort to minimize waste, polyurethane soy foam insulation shavings shall be placed in stud walls without insulation or fire rating requirements.

3.11 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied on the "warm" interior side of all insulation materials and as specifically indicated on drawings. Vapor retarder shall provide a continuous barrier over the entire building. Provide continuous joints, seams and sealed edges at wall perimeter, window and door frames, and all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations per manufacturer's written instructions for installation. Joints and seams in the vapor retarder shall be lapped and sealed over supporting framing members. Provide a sealed seam between wall and ceiling applications. Sealing shall be by vapor retarder manufacturer's adhesive and/or tape materials. All penetrations to the moisture barrier, either designed or accidental, shall be repaired in a manner approved by the Contracting Officer.

END OF SECTION

SECTION 07413

METAL WALL PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ADM1	(2000) Aluminum Design Manual

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 755/A 755M	(2004a) Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A 792/A 792M	(2003) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(2002e1) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid

	Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2001) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 5894	(1996) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2001) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM G 154	(2000ae1) Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

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LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 DESCRIPTION OF WALL PANEL SYSTEM

Factory color finished, galvanized or galvalume metal wall panel system with concealed fastener attachment. Panel profile shall be smooth face batten seam as shown on drawings.

1.3 GENERAL DESIGN REQUIREMENTS

Criteria, loading combinations, and definitions shall be in accordance with ASCE 7. Maximum calculated fiber stress shall not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads shall be limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Members and connections not shown on the drawings shall be designed by the Contractor. Siding panels and accessories shall be the products of the same manufacturer. Steel siding design shall be in accordance with AISI SG-973. Aluminum siding

design shall be in accordance with AA ADM1.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Siding; G

Drawings consisting of catalog cuts, panel configuration, system assembly, attachment details, flashing details, design and erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be accompanied by engineering design calculations for the siding panels. Drawings shall be approved by the metal wall panel manufacturer prior to submission.

SD-03 Product Data

Wall panels; G

Closures

Flashing

Accessories

Fasteners

Gaskets and Insulating Compounds

SD-04 Samples

WALL PANEL;

One piece of type and finish (exterior and interior) to be used, 9 inches long, full width.

Factory-applied Color Finish Charts; G

Provide standard and custom color charts for wall panel and accessory color selection if specific color indicated on drawings is not submitted.

Accessories;

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and

configuration.

Fasteners;

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Gaskets and Insulating Compounds;

Two samples of each type to be used and descriptive data.

SD-05 Design Data

Wind load calculations; G

Calculations shall be prepared, signed, and sealed by a registered structural engineer.

SD-06 Test Reports

Salt Spray Test;

SD-07 Certificates

Wall Panels; G

Accessories;

Certificates from the wall panel manufacturer attesting that the panels and accessories conform to the specified requirements and are suitable for the installation environment.

SD-08 Manufacturer's Instructions

INSTALLATION; G

Submit manufacturer's printed installation manual and instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle panel materials, bulk products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

1.5.1 Delivery

Deliver materials to the site in dry and undamaged condition. Provide adequate packaging to protect materials during shipment. Crated materials shall not be uncrated until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for

damage, deformation, dampness, and staining. Remove affected materials from the site. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

1.5.2 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store wall panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Storage accommodations for metal wall panels shall provide good air circulation and protection from surface staining. Secure coverings and stored items to protect from wind displacement.

1.5.3 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or installation. Protect finishes from scratching and abrasion.

1.6 WARRANTIES

The Contractor shall provide a weathertight material and workmanship warranty for the metal wall panel system installation for a period of 5 years and to include a manufacturer's 5 year warranty against cracking, peeling, or delamination of the color finish and corrosion of the base metal, and 10 year warranty against the corrosion of fasteners caused by ordinary wear and tear by the elements. The warranties shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

1.7 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for metal siding products.

PART 2 PRODUCTS

2.1 WALL PANEL

Panels shall be steel and shall have a factory-applied color finish. Panel profile shall be smooth face batten seam as shown on drawings. Wall panels shall have parallel panel side seams at adjacent sheets designed for full coverage with battens. Width of sheets shall provide spacing between battens of approximately 400 mm. Wall panels shall be fastened to sheathing and wall framing using concealed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface when length of run is 30 feet or less. When length of run exceeds 30 feet, each sheet in the run shall extend over two or more spans. Sheets longer than 30 feet may be furnished if approved by the Contracting Officer. Panels shall be formed without warping, waviness, or ripples that are not a

part of the panel profile and shall be free of damage to the finish coating system.

2.1.1 Steel Panels

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 40 and minimum G90 galvanized smooth metallic coating; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall panel material shall be minimum 0.60 mm (24 gage) thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness.

2.2 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride (PVDF)finish on both sides. The exterior finish shall consist of a baked-on finish coat with an appropriate prime coat. Total color coating system thickness shall be not less than 0.025 mm (1 mil)and with any additional primer and finish coat thickness required to meet the color finish performance requirements specified. Provide manufacturer's standard factory-applied clear coat system (if available) over color finish coat. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.02 mm (0.75 mil)dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm (0.2 mil) thickness. The interior color finish shall consist of the same coating and dry film thickness as the exterior. Finish coat color shall match the color indicated on the drawings. The exterior color finish shall meet the performance requirements specified.

2.2.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2014 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8, few blisters, as determined by ASTM D 714; no rusting, as determined by ASTM D 610; and a rating of 6, less than 3 mm (1/8 inch) creepage from scribe as determined by ASTM D 1654.

2.2.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.2.3 Accelerated Weathering, Chalking Resistance and Color Change

Coating sample shall withstand weathering test of 5000 hours , in accordance with ASTM D 4587 and ASTM G 154, Type D using without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating of less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the

accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.2.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.2.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm (0.50 inch) diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.

2.2.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

2.4 FASTENERS

Fasteners for steel panels shall be zinc-coated steel, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for attaching wall panels to supports shall provide both tensile and shear strength of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed wall fasteners shall be color finished or provided with plastic color caps to match the panels. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be as recommended by the manufacturer.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 4.7 mm (3/16 inch) and cap or nut for holding panels

against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 3.7 mm (0.145 inch) with a shank length of not less than 13 mm (1/2 inch) for fastening panels to steel and not less than 25 mm (1 inch)for fastening panels to concrete.

2.4.4 Blind Rivets

Blind rivets shall be aluminum with 4.7 mm (3/16 inch)nominal diameter shank or stainless steel with 3.2 mm (1/8 inch) nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 6 mm (1/4 inch) diameter, shouldered or plain shank as required, with proper nuts.

2.5 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt, as recommended by the wall panel manufacturer. Silicone based sealants are prohibited, unless approved otherwise by the panel manufacturer and the Contracting Officer. Exposed sealant shall be colored to match adjacent components and shall cure to a rubberlike consistency. Concealed sealant shall be non-hardening type.

2.6 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall meet specified requirements and be in accordance with the manufacturer's installation instructions and approved shop drawings. Correct defects or errors in materials and installation. Do not install damaged materials. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged materials shall be removed from the site.

3.1.1 Wall Panels and Accessories

Wall panels shall be applied with the longitudinal configurations in the vertical position. Provide panels in longest obtainable lengths, with end laps occurring only at solid blocking members. Minimum end laps for panels shall be 50 mm (2 inches)and shall occur only over solid blocking. Side laps shall be batten seam ribs based on manufacturer's standard. Seal side and end laps with joint-sealing material. Flash wall panels at base and at top, around windows, door frames, framed louvers, and other similar openings. Place closures, flashing, and sealing materials to achieve complete water tightness. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.1.1 Concealed Fastener Wall Panels

Panels shall be fastened to framing members and sheathing with concealed fastening clips or other concealed devices standard with the manufacturer. Spacing of fastening clips and fasteners shall be in accordance with the manufacturer's written instructions. Spacing of fasteners and anchor clips along the panel edges shall not exceed 300 mm (12 inches) on center except when otherwise recommended by the panel manufacturer and approved by the Contracting Officer. Fasteners shall not puncture metal sheets except as approved for flashing, closures, and trim; exposed fasteners shall be installed in straight lines. Joints at accessories shall be sealed.

3.2 CLEAN UP AND FINISH TOUCH-UP

Clean exposed sheet metal work at completion of installation. Remove metal shavings and filings. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish.

3.3 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, additional measures shall be taken as deemed necessary by the Contracting Officer to determine the extent of the deficiency and corrective actions shall be as directed by the Contracting Officer.

3.4 FIELD QUALITY CONTROL

3.4.1 Construction Monitoring

Contractor shall make visual inspections as necessary to ensure compliance with specified requirements. Additionally, verify the following:

Materials comply with the specified requirements.

All materials are properly stored, handled and protected from damage. Damaged materials are removed from the site.

Framing and substrates are in acceptable condition, in compliance with specification, prior to application of wall panels.

Panels are installed without buckles, ripples, or waves and in uniform alignment and modulus.

Side laps are formed, sealed, fastened or seam locked as required.

The proper number, type, and spacing of attachment clips and fasteners are installed.

Installer adheres to specified and detailed application parameters.

Associated flashings and sheet metal are installed in a timely manner in accord with the specified requirements.

-- End of Section --

SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ADM1	(2000) Aluminum Design Manual

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A 463/A 463M	(2002a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(2003) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM D 146	(1997e1) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D 412	(1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 1308	(2002) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244	(2002e1) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 5894	(1996) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2001) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2001) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G 154	(2000ae1) Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Standing Seam Metal Roof; G

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

SD-03 Product Data

Design Analysis; G

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

Qualifications

Qualifications of the manufacturer and installer.

SD-04 Samples

Accessories; G

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; G

One piece of each type to be used, 225 mm long, full width.

Factory Color Finish; G

75 by 125 mm samples of each type and color.

Fasteners

Samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for

testing to establish compliance with specified requirements.

Gaskets and Insulating Compounds

Samples of each type to be used and descriptive data.

Sealant

Samples, approximately 0.5 kg , and descriptive data.

Concealed Anchor Clips

Samples of each type used.

EPDM Rubber Boots

One of each type.

SD-06 Test Reports

Wind Uplift Resistance; G

The report shall include the following information:

a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.

b. Details of the anchor clip, dimensions, and thickness.

c. Type of fasteners, size, and the number required for each connection.

d. Purlins/subpurlins size and spacing used in the test.

e. Description of the seaming operation including equipment used.

f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.

g. Any additional information required to identify the SSSMR system tested.

h. Signature and seal of an independent registered engineer who witnessed the test.

SD-07 Certificates

Structural Standing Seam Metal Roof

a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified

requirements.

b. Certification that materials used in the installation are mill certified.

c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Contractor's Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, the 20-year Manufacturer's Material Warranties, and the manufacturer's 20-year system weathertightness warranty.

SD-12 LEED Documentation

Recycled Content; G
Manufacturing Plant Location; G
Regionally Extracted Materials; G
Heat Island Effect: Roof; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where standing seam metal roofing was produced, percentage of standing seam metal roofing's raw materials extracted regionally and manufacturer's test data showing conformance with solar reflectance and emissivity requirements of Heat Island Effect: Roof in accordance with LEED-NC RG

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.3.1 Structural Standing Seam Metal Roof

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories,

components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

1.3.2 Qualifications

1.3.2.1 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.3.2.2 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.4 DESIGN ANALYSIS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.4.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.4.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.4.3 Live Loads

1.4.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 1335 N concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.4.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a

minimum uniform live load of 960 Pa.

1.4.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

1.4.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

a. Single fastener in each connection.....3.00

b. Two or more fasteners in each connection...2.25

1.4.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 104 degrees C during the life of the structure.

1.4.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

1.4.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI SG-973. Aluminum panels shall be designed in accordance with AA ADM1. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.4.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 9

mm will be allowed when the supporting structural members are prepunched or predrilled.

1.5 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 750 mm. Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 1.5 m . External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, and curbs; exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the

installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's 20 year, non-prorated, system weathertightness warranty.

1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

1.9 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for standing seam metal roofing products.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9 m . When length of run exceeds 9 m and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 30 m may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 600 mm of coverage in place. SSSMR system with roofing panels greater than 300 mm in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 37 mm for rolled seam and 50 mm for seams that are not rolled.

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.584 mm thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 10 mm for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 6 mm diameter. Blind (pop) rivets shall be not less than 7 mm minimum diameter.

2.5 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness. The interior color finish shall consist of the same coating and dry film thickness as the exterior. The exterior color finish shall meet the test requirements specified below.

2.5.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 2 0 to 3.0 mm failure at scribe, as determined by ASTM D 1654.

2.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.5.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154, test condition UVA-340 lamp, 4h UV at 60 degrees C followed by 4h CON at 50 degrees C for 2,000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.5.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no cracking.

2.5.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.5.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.6 INSULATION

Structural Insulated Panels (SIP) used as roof decking contain insulation, see Section 06100 ROUGH CARPENTRY. No additional isulation is required as part of the SSSMR installation.

2.7 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable roof color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.8 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.9 SELF ADHERING ELASTOMERIC MEMBRANE

Elastomeric membrane shall be a cold applied composite self-adhering membrane, minimum 1.0 mm (0.040 inch) thick, high strength polyethylene film with slip resistant embossing, coated on one side with a thick layer of adhesive-consistency rubberized asphalt, interwound with a disposable silicone coated release sheet. The tensile strength and elongation values shall be not less than 1724 kPa when tested in accordance with ASTM D 412 and pliability shall be unaffected when tested in accordance with ASTM D 146. Membrane is not applied to the entire roof surface, see paragraph 3.2.4 for areas of application.

2.10 SLIP SHEET

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter rosin-sized, unsaturated building paper.

2.11 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.12 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

Prefabricated curbs and equipment supports shall be of structural quality, hot-dipped galvanized or galvanized sheet steel, factory primed and prepared for painting with mitered and welded joints. Integral base plates and water diverter crickets shall be provided. Minimum height of curb shall be 200 mm above finish roof. Curbs shall be constructed to match roof slope and to provide a level top surface for mounting of equipment. Curb flange shall be constructed to match configuration of roof panels. Curb size shall be coordinated, prior to curb fabrication, with the mechanical equipment to be supported. Strength requirements for equipment supports shall be coordinated to include all anticipated loads. Flashings shall not be rigidly attached to underlying structure.

2.13 SNOW RETENTION SYSTEM

Snow retention system shall be composed of non-penetrating clamps mounted on standing seams with a continuous metal "fence" anchored to clamps. Snow fence shall be 50 mm in height and mounted perpendicular to, and immediately above standing seams. Fence shall be finished to match the SSSMR panel color.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.2 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

3.1.3 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the surface of SIP. Length of screws shall be selected to ensure that bottom face of SIP are not penetrated by screw point. The maximum distance, parallel to the seams, between clips shall be 750 mm on center at the corner, edge, and ridge zones, and 1500 mm maximum on centers for the remainder of the roof.

3.1.4 Attachment Method

SSSMR shall be installed as fixed ridge, floating eave type assembly. No fasteners shall be visible at the eave.

3.2 SELF ADHERING ELASTOMERIC MEMBRANE UNDERLAYMENT

3.2.1 Surface Preparation

Dust, dirt, loose nails or other protrusions shall be removed. Priming is not required for wood or metal surfaces but is necessary on concrete or masonry surfaces.

3.2.2 Primer

Primer shall be applied at a coverage rate of 6-9 sq. meters/L. Primer shall be applied by spray or paint roller.

3.2.3 Temperature

Membrane shall be applied only in fair weather when air and surface temperatures are above 5 degrees C.

3.2.4 Membrane Application

Membrane shall be applied according to manufacturer's instructions at eaves, rakes, valleys, parapet walls, ridges, steeple perimeter and roof penetrations. Membrane shall be adhered directly to surface of SIP. Membrane shall be cut into 3 to 4.5 meter lengths and shall be re-rolled. The release paper shall be peeled back 300 to 600 mm and the membrane shall be aligned on the lower edge of the roof and the first 300 to 600 mm shall be placed. The release paper under the membrane shall be pulled and peeled from the membrane. The membrane shall be pressed in place. Lower edges shall be rolled firmly with a wallpaper or hand roller. Ends and edges shall be overlapped a minimum of 150 mm. Membrane shall not be folded onto an exposed face of the roof edge.

3.2.5 Valley and Ridge Application

The membrane shall be cut into 1.2 to 1.8 meter lengths. The release paper shall be peeled and the sheet centered over the valley or ridge, draped and pressed in place working from the center of the valley or ridge outward in each direction. For valleys, membrane shall be applied starting at the low point and working upwards. Sheets shall overlap a minimum of 150 mm.

3.2.6 Vertical Membrane Flashings

Vertical wall installations shall receive primer prior to the application of membrane. Primer shall be applied at a coverage rate of 6-9 sq. meters/L. Membrane shall be turned up walls, parapets and dormers as indicated on the drawings. Vertical membrane terminations shall be mechanically fastened. Vertical terminations shall receive a troweling of mastic as approved by the membrane manufacturer. Membrane may be folded onto the fascia, provided it will be covered by a gutter metal edge or other material.

3.2.7 Protection

Elastomeric membrane underlayment shall not be left permanently exposed to sunlight. Membrane shall be covered with exposed roofing materials as soon as possible. Membrane damaged due to exposure to sunlight shall be patched prior to the application of final roof covering.

3.3 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the field of the roof deck to cover exposed SIP. Slip sheet shall not be adhered or otherwise connected to the bottom of the SSSMR.

3.4 SNOW RETENTION INSTALLATION

Install snow retention system on high roof (above Worship, Expansion and Activity areas) eaves only. SSSMR system shall not be penetrated in any way. Install as indicated on drawings.

3.5 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

_____

(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).

2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.

3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.

4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.

5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.

6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.

7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

**REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION 07530

ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOF MEMBRANE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM D 4637	(2003) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D 4811	(2004) Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing
ASTM D 6369	(1999) Design of Standard Flashing Details for EPDM Roof Membrane
ASTM E 108	(2000) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2003) Approval Guide
FM P7825c	(2003) Approval Guide Building Materials

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0405	(2001, 5th Ed) Roofing and Waterproofing Manual (2 Vol)

UNDERWRITERS LABORATORIES (UL)

UL 790	(1997; Rev thru Jul 1998) Tests for Fire Resistance of Roof Covering Materials
UL RMSD	(2003) Roofing Materials and Systems Directory

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEMS

Fully adhered EPDM roof membrane system applied over insulation substrate. EPDM is limited to roof areas at entrance porticos as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing System; G

Roof plan drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, spacing of perimeter, corner, and infield fasteners, as applicable. The drawing shall reflect the project roof plan of each roof level and conditions indicated. Detail showing construction of water cutoffs to be used at membrane terminations at the end of a day's work to seal the roofing system from water intrusion.

SD-03 Product Data

EPDM Sheet; G

Seam Tape

Bonding Adhesive; G

Lap Splice Adhesive

Water Cutoff Mastic/Water Block

Lap Cleaner, Lap Sealant, and Edge Treatment

Flashing; G

Flashing Accessories

Flashing Tape

Fasteners and Plates

PRE-MANUFACTURED ACCESSORIES; G

Sample warranty certificate; G

Data shall include written acceptance by the roof membrane manufacturer of the insulation and other products and accessories to be provided. Products shall be as listed in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

Inspection; G

The inspection procedure for substrate suitability including decks, curbs and insulation installation, prior to start of the work. Inspection procedures during and after placement of the membrane, and after completion of work by other trades.

SD-07 Certificates

Qualification of Manufacturer

Certify that the manufacturer of the roof membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer."

Qualification of Applicator

Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

Wind Uplift Resistance classification, as applicable; G

Fire Resistance classification; G

Submit the roof system assembly wind uplift and fire rating classification listings.

SD-08 Manufacturer's Instructions

APPLICATION; G

Application Method, including pattern and frequency of mechanical attachments required in the field of roof, corners, and perimeters to provide for the specified wind resistance; G

Membrane Flashing; G

Seam Tape

Tape Seams / Lap Splices

Adhesive Seams / Lap Splices

Perimeter Attachment

primer

fasteners

Pre-manufactured accessories

cold weather installation; G

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

SD-11 Closeout Submittals

WARRANTY

INFORMATION CARD

INSTRUCTIONS TO GOVERNMENT PERSONNEL

Include copies of Material Safety Data Sheets for maintenance/repair materials.

SD-12 LEED Documentation

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of the location of the manufacturing plant where ethylene propylene diene monomer roofing was produced and percentage of ethylene propylene diene monomer roofing's raw materials extracted regionally in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for ethylene propylene diene monomer roofing products.

1.5 QUALITY ASSURANCE

1.5.1 Qualification of Manufacturer

EPDM sheet roofing membrane manufacturer shall have at least 5 years experience in manufacturing EPDM roofing products.

1.5.2 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the roof membrane manufacturer and shall have a minimum of three years experience as an approved, authorized, or licensed applicator with

that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names, locations and client contact information of 5 projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.5.3 Fire Resistance

Complete roof covering assembly shall:

a. Be Class A rated in accordance with ASTM E 108, FM AS 4470, or UL 790; and

b. Be listed as part of Fire-Classified roof deck construction in the UL RMSD or Class I roof deck construction in the FM P7825.

FM or UL approved components of the roof covering assembly shall bear the appropriate FM or UL label.

1.5.4 Wind Uplift Resistance

Complete roof covering assembly, including insulation, shall be rated Class 1-90 in accordance with FM P7825 capable of withstanding an uplift pressure of 4.30 kPa per square meter (90 psf). Non-rated systems shall not be installed. Provide wind load calculations and submit engineering calculations and substantiating data to validate wind resistance of any non-rated roof system. Wind uplift calculations shall be based on a design wind speed of 137 km/h (85 mph) in accordance with ASCE 7.

1.5.5 Preroofing Conference

After approval of submittals and before performing roofing and insulation system installation work, hold a preroofing conference (at the same time as SSSMR conference) to review the following:

a. Drawings, specifications and submittals related to the roof work;

b. Roof system components installation;

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

e. Quality control plan for the roof system installation;

f. Safety requirements.

Pre-roofing conference scheduling shall be coordinated with the Contracting Officer. The conference shall be attended by the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, and representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Delivery

Deliver materials in their original, unopened containers or wrappings with labels intact and legible. Where materials are covered by a referenced specification number, the labels shall bear the specification number, type, class, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow continuity of work.

1.6.2 Storage

Store and protect materials from damage and weather in accordance with manufacturer's instructions, except as specified otherwise. Keep materials clean and dry. Store and maintain adhesives, sealants, primers and other liquid materials above 15 degrees C (60 degrees F). Insulated hot boxes or other enclosed warming devices shall be required in cold weather. Mark and remove damaged materials from the site. Use pallets to support and canvas tarpaulins to completely cover material materials stored outdoors. Do not use polyethylene as a covering. Locate materials temporarily stored on the roof in approved areas, and distribute the load to stay within the live load limits of the roof construction. Remove unused materials from the roof at the end of each days work.

1.6.3 Handling

Prevent damage to edges and ends of roll materials. Damaged materials shall not be installed in the work. Select and operate material handling equipment so as not to damage materials or applied roofing. Do not use materials contaminated by exposure or moisture. Remove contaminated materials from the site. When hazardous materials are involved, adhere to the special precautions of the manufacturer. Adhesives may contain petroleum distillates and may be extremely flammable; prevent personnel from breathing vapors, and do not use near sparks or open flame.

1.7 ENVIRONMENTAL REQUIREMENTS

Do not install EPDM sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface, or when condensation develops on surfaces during application. Unless recommended otherwise by the EPDM sheet manufacturer and approved by the Contracting Officer, do not install EPDM sheet when air temperature is below 4 degrees C (40 degrees) F or within 3 degrees C (5 degrees F) of the dewpoint. Follow manufacturer's printed instructions for installation

during cold weather conditions.

1.8 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counterflashing are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. Application of roofing shall immediately follow application of insulation as a continuous operation. Roofing operations shall be coordinated with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.

1.9 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Revision or amendment to standard membrane manufacturer warranty shall be provided as required to comply with the specified requirements.

1.9.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 10-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. The warranty shall run directly to the Government and commence at time of Government's acceptance of the roof work. The warranty shall state that:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, splits, tears, cracks, delaminates, separates at the seams, shrinks to the point of bridging or tenting membrane at transitions, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship shall be the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work shall be the responsibility of the roof membrane manufacturer.

b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others shall not void the warranty.

1.9.2 Roofing System Installer Warranty

The roof system installer shall warrant for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral

to a complete watertight roof system assembly. The warranty shall run directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials shall be the responsibility of the roof system installer. All costs associated with the repair or replacement work shall be the responsibility of the installer.

1.9.3 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period shall be approved, as required, and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.10 CONFORMANCE AND COMPATIBILITY

The entire roofing and flashing system shall be in accordance with specified and indicated requirements, including fire and wind resistance requirements. Work not specifically addressed and any deviation from specified requirements shall be in general accordance with recommendations of the NRCA 0405, membrane manufacturer published recommendations and details, ASTM D 6369, and compatible with surrounding components and construction. Any deviation from specified or indicated requirements shall be submitted to the Contracting Officer for approval prior to installation.

1.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed elastomeric roofing with the contract requirements. The procedure shall include a checklist of points to be observed. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

1) Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.

2) Verification of compliance of materials before, during and after installation.

3) Inspection of insulation, nailers, flashings, penetrations and work requiring coordination with roofing.

4) Inspection of membrane placement, splicing, and attachment.

5) Inspection of placement of ballast and walkways.

6) Verification of ballast weight.

PART 2 PRODUCTS

2.1 MATERIALS

Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Materials provided shall be free of defects and suitable for the service and climatic conditions of the installation.

2.1.1 EPDM Sheet

Ethylene Propylene Diene Terpolymer (EPDM), ASTM D 4637, Type I, non-reinforced, 1.5 mm (0.060 inch)nominal thickness for fully adhered application. Minimum thickness shall not be less than minus 10 percent of the specified thickness value. EPDM membrane thickness specified is exclusive of backing material on the EPDM membrane. Principal polymer used in manufacture of the membrane sheet shall be greater than 95 percent EPDM. Width and length of sheet shall be as recommended by the manufacturer.

2.1.2 Seam Tape

Double-sided synthetic rubber tape, minimum 0.76 mm (0.03 inch) thick, minimum 75 mm (3 inch) wide. Seam tape shall be as supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet materials to each other for the application specified and conditions encountered. 150 mm (6 inch) wide tape is required for seam seals along lines of mechanical attachment of membrane.

2.1.3 Lap Splice Adhesive

Low volatile organic compound (VOC) synthetic rubber adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet membrane materials to each other in areas of membrane flashing. Splice adhesive shall not be used to form membrane seams in field of roof or at standard base flashing conditions.

2.1.4 Bonding Adhesive

Low volatile organic compound (VOC) synthetic rubber adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for bonding EPDM membrane materials to insulation, wood, metal, concrete or other substrate materials. Bonding adhesive shall not be used to bond membrane materials to each other.

2.1.5 Lap Cleaner, Lap Sealant, and Edge Treatment

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.6 Water Cutoff Mastic/Water Block

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.7 Membrane Flashing and Flashing Accessories

Membrane flashing, including self-adhering membrane flashing, perimeter flashing, flashing around roof penetrations, and prefabricated pipe seals, shall be minimum 1.1 mm (0.045 inch) minimum cured EPDM, as recommended by the roof membrane manufacturer or minimum 1.4 mm (0.055 inch) thick uncured EPDM sheet in compliance with ASTM D 4811, Type I. Cured EPDM membrane shall be used to the maximum extent recommended by the roof membrane manufacturer. Uncured flashing material shall be limited to reinforcing inside and outside corners and angle changes in plane of membrane, and to flash scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical.

2.1.7.1 Flashing Tape

EPDM-backed synthetic rubber tape, minimum 150 mm wide as supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.8 Membrane Fasteners and Plates

Coated, corrosion-resistant fasteners as recommended by the roof membrane manufacturer and meeting the requirements of FM AS 4470 and FM P7825c for Class I roof deck construction and the wind uplift resistance specified. As supplied and warranted for the substrate type(s) by EPDM sheet manufacturer and recommended by EPDM sheet manufacturer's printed data.

2.1.8.1 Stress Plates for Fasteners

Flat corrosion-resistant round stress plates as recommended by the roof membrane manufacturer's printed instructions and meeting the requirements of FM AS 4470; not less than 50 mm in diameter. Discs shall be formed to prevent dishing or cupping.

2.1.8.2 Auxiliary Fasteners

Corrosion resistance screws, nails, or anchors suitable for intended attachment purpose and as recommended by the roof membrane manufacturer.

2.1.9 PRE-MANUFACTURED ACCESSORIES

Pre-manufactured accessories shall be manufacturer's standard for intended purpose, comply with applicable specification section, compatible with the membrane roof system and approved for use by the roof membrane manufacturer.

2.1.9.1 Pre-fabricated Curbs

Curbs shall be 12 gauge G90 galvanized with minimum 100 mm flange for attachment to roof nailers. Curbs shall provide minimum height of 250 mm (10 inches) above the finished roof membrane surface.

2.1.10 Roof Insulation Below EPDM Sheet

Insulation system and facer material shall be compatible with membrane

application specified and as approved by the roof membrane manufacturer.

2.1.11 Wood Products

As specified in Section 06100 ROUGH CARPENTRY, except that fire retardant treated materials shall not be in contact with EPDM membrane or EPDM accessory products, unless approved by the membrane manufacturer and the Contracting Officer.

2.1.12 Membrane Liner

Self-adhering EPDM membrane liner conforming to ASTM D 4637, or other waterproof membrane liner material as approved by the roof membrane manufacturer and the Contracting Officer.

PART 3 EXECUTION

3.1 ENVIRONMENTAL CONDITIONS

Membrane shall not be installed in high wind, inclement weather or when there is ice, frost or moisture on the deck, insulation or membrane. Membrane shall not be installed when air temperature is below the minimum specified by the membrane manufacturer.

3.2 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

a. Drains, curbs, perimeter walls, roof penetrating components, and equipment supports are in place.

b. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation.

c. The plane of the substrate does not vary more than 6 mm within an area 3 by 3 meters when checked with a 3 meter straight edge placed anywhere on the substrate.

d. Substrate is sloped to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counterflashing, and will permit mechanical fastening of the base flashing materials.

f. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inches above finished roofing surface.

g. Pressure-preservative treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. Surface-applied nailers are the same thickness as the roof insulation.

h. Avoid contact of EPDM materials with fire retardant treated wood, except as approved by the roof membrane manufacturer and Contracting Officer.

i. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 90 mm .

k. Exposed nail heads in wood substrates are properly set. Warped and split boards and sheets have been replaced. There are no cracks or end joints 6 mm in width or greater.

l. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 6 mm in width. Insulation is being roofed over on the same day the insulation is installed.

3.3 APPLICATION

Apply entire EPDM sheet utilizing fully adhered application method. Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer.

3.3.1 Special Precautions

a. Do not dilute coatings or sealants unless specifically recommended by the materials manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning EPDM sheet.

b. Keep liquids in airtight containers, and keep containers closed except when removing materials.

c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 15 to 27 degrees C (60 to 80 degrees F) prior to use. Avoid excessive adhesive application and adhesive spills, as they can be destructive to some elastomeric sheets and insulations; follow adhesive manufacturer's printed application instructions. Mix and use liquid components in accordance with label directions and manufacturer's printed instructions.

d. Provide clean, dry cloths or pads for applying membrane cleaners and cleaning of membrane

e. Do not use heat guns or open flame to expedite drying of adhesives or primers.

f. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.

g. Do not use equipment with sharp edges which could puncture the EPDM sheet.

h. Shut down air intakes and any related mechanical systems and seal open vents and air intakes when applying solvent-based materials in the area of the opening or intake. Coordinate shutdowns with the Contracting Officer.

3.3.2 EPDM Sheet Roofing

Roof membrane sheet shall be watertight and free of contaminants and defects that might affect serviceability. Edges of sheet shall be uniform, straight, and flat. Unroll EPDM sheet roofing in position without stretching membrane. Inspect for holes. Remove sections of EPDM sheet roofing that are damaged. Allow sheets to relax minimum 30 minutes before seaming. Lap sheets as specified, to shed water, and as recommended by the roof membrane manufacturer's published installation instructions for the application required but not less than 75 mm in any case.

3.3.3 Application Method

3.3.3.1 Fully Adhered Membrane Application

Layout membrane and side lap adjoining sheets in accordance with membrane manufacturer's printed installation instructions. Allow for sufficient membrane to form proper membrane terminations. Remove dusting agents and dirt from membrane and substrate areas where bonding adhesives are to be applied. Apply specified adhesive evenly and continuously to substrate and underside of sheets at rates recommended by the roof membrane manufacturer's printed application instructions. When adhesive is spray applied, roll with a paint roller to ensure proper contact and coverage. Do not apply bonding adhesive to surfaces of membrane in seam or lap areas. Allow adhesive to flash off or dry to consistency prescribed by manufacturer before adhering sheets to the substrate. Roll each sheet into adhesive slowly and evenly to avoid wrinkles; broom or roll the membrane to remove air pockets and fishmouths and to ensure full, continuous bonding of sheet to substrate. Form field lap splices or seams as specified. Check all seams and ensure full lap seal. Apply lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

3.3.4 Tape Seams / Lap Splices

Field form seams, or lap splices, with seam tape in accordance with membrane manufacturer's printed instructions and as specified. Clean and prime mating surfaces in the seam area. After primer has dried or set in accordance with membrane manufacturer's instructions, apply seam tape to bottom membrane and roll with a 75 mm to 100 mm wide smooth silicone or steel hand roller, or other manufacturer approved rolling device, to ensure full contact and adhesion of tape to bottom membrane. Tape end laps shall be minimum 25 mm. Roll top membrane into position to check for proper overlap and alignment. Remove release paper from top of seam tape and form seam splice. Ensure top membrane contact with seam tape as release paper is removed. Roll the closed seam with a smooth silicone or steel hand roller, rolling first across the width of the seam then along the entire length, being careful not to damage the membrane. Apply minimum 225 mm long strip of membrane-backed flashing tape over T-intersections of roof

membrane. Roll tape to ensure full adhesion and seal over T-joint.

3.3.5 Adhesive Seams / Lap Splices

Field-applied adhesive formed seams shall only be used in flashing areas where approved by the membrane manufacturer and the Contracting Officer. Adhesive formed seams shall not be used for field of roof membrane seaming. Thoroughly and completely clean mating surfaces of materials throughout the lap area. Remove all dirt, dust, and contaminants and allow to dry. Apply primer as recommended by the membrane manufacturer. Apply splice adhesive with a 75 mm to 100 mm wide, 13 mm thick, solvent-resistant brush in a smooth, even coat with long brush strokes. Bleed out brush marks. Do not apply adhesive in a circular motion. Simultaneously apply adhesive to both mating surfaces in an approximate 0.63 mm to 0.75 mm wet film thickness, or other thickness as recommended by the roof membrane manufacturer's printed instructions. Allow the splice adhesive to set-up in accordance with membrane manufacturer's instructions. Perform manufacturer recommended field check to test for adhesive readiness prior to closing seam. Apply a 3 mm to 6 mm bead of in-seam sealant approximately 13 mm from the inside edge of the lower membrane sheet prior to closing the seam. Ensure the in-seam sealant does not extend onto the splice adhesive. Maintain the full adhered seam width required. Roll the top membrane onto the mating surface. Roll the seam area with a 50 mm to 75 mm wide, smooth silicone or steel hand roller. A minimum of 2 hours after joining sheets and when the lap edge is dry, clean the lap edge with membrane manufacturer recommended cleaner and apply a 6 mm to 9 mm bead of lap sealant centered on the seam edge. With a feathering tool, immediately feather the lap sealant to completely cover the splice edge, leaving a mound of sealant over the seam edge. Lap sealant shall be applied to all adhesive formed seams.

3.3.6 Perimeter Attachment

Adhesive bond or mechanically secure roof membrane sheet at roof perimeter in a manner to comply with wind resistance requirements and in accordance with membrane manufacturer's printed application instructions. When adhesively bonding a mechanically fastened system in perimeter areas, the perimeter boundary of the adhesive bond shall be the same as the boundary required for additional perimeter mechanical fastening to meet wind resistance requirements.

3.3.7 Securement at Base Tie-In Conditions

Mechanically fasten the roof membrane at penetrations, at base of curbs and walls, and at all locations where the membrane turns and angle greater than 4 degrees (1:12). Space fasteners a maximum of 300 mm on center, except where more frequent attachment is required to meet specified wind resistance or where recommended by the roof membrane manufacturer. Flash over fasteners with a fully adhered layer of material as recommended by the roof membrane manufacturer's printed data.

3.3.8 Membrane Flashing

Install flashing and flashing accessories as the roof membrane is

installed. Apply flashing to cleaned surfaces and as recommended by the roof membrane manufacturer and as specified. Utilize cured EPDM membrane flashing and prefabricated accessory flashings to the maximum extent recommended by the roof membrane manufacturer. Uncured flashing material shall be limited to reinforcing inside and outside corners and angle changes in plane of membrane, and to flashing scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical. Extend base flashing not less than 8 inches above roofing surface and as necessary to provide for seaming overlap on roof membrane as recommended by the roof membrane manufacturer. Seal flashing membrane for a minimum of 75 mm (3 inches) on each side of fastening device used to anchor roof membrane to nailers. Completely adhere flashing sheets in place. Seam flashing membrane in the same manner as roof membrane, except as otherwise recommended by the membrane manufacturer's printed instructions and approved by the Contracting Officer. Reinforce all corners and angle transitions by applying uncured membrane to the area in accordance with roof membrane manufacturer recommendations. Mechanically fasten top edge of base flashing with manufacturer recommended termination bar fastened at maximum 300 mm on center. Sheet metal flashing shall be installed over the termination bar in the completed work. Mechanically fasten top edge of base flashing for all other terminations in a manner recommended by the roof membrane manufacturer. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing are specified under Section 07600, "Flashing and Sheet Metal."

3.3.8.1 Flashing at Roof Drain

Roof drains are specified in Section 15400 PLUMBING SYSTEMS. Flashing for roof drains, are specified in Section 07600 FLASHING AND SHEET METAL. Provide a tapered insulation sump into the drain bowl area. Tapered slope shall not exceed 18 degrees (4:12) for unreinforced membrane and 5 degrees (1:12) for reinforced membrane. Tapered insulation shall have surface suitable for adhering membrane in the drain sump area. Avoid field seams running through or within 600 mm of roof drain, or as otherwise recommended by the roof membrane manufacturer. Adhere the membrane to the tapered in the drain sump area. Apply water block mastic and extend membrane sheets over edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Membrane shall be free of wrinkles and folds in the drain area. Securely clamp membrane in the flashing clamping ring. Ensure membrane is cut to within 20 mm (3/4 inch) of inside rim of clamping ring to maintain drainage capacity. Do not cut back to bolt holes.

3.3.9 Pre-fabricated Curbs

Prefabricated curbs shall be securely anchored to nailer or other base substrate and flashed with EPDM membrane flashing materials.

3.3.9.1 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories, or isolated paver block, are set on the membrane, adhere reinforced membrane or walkpad material, as recommended by the roof membrane manufacturer, to bottom of accessories prior to setting on roofing membrane. Specific method of installing set-on accessories must permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.4 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied membrane roofing system from water intrusion.

3.4.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of the roof membrane system in an effective manner. Seal off flutes in metal decking along the cutoff edge. Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

3.4.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Remove temporary flashing before applying permanent flashing.

3.4.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.5 PROTECTION OF FINISHED ROOFING

The roofing membrane shall be protected from damage by other trades. After completion of work by other trades, the protection shall be removed and the roof shall be inspected. Any damage shall be repaired in accordance with the recommendations of the roofing manufacturer.

3.6 CLEAN UP

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.7 FIELD QUALITY CONTROL

3.7.1 Construction Monitoring

During progress of the roof work, Contractor shall make visual inspections as necessary to ensure compliance with specified parameters. Additionally,

verify the following:

a. Equipment is in working order. Metering devices are accurate.

b. Materials are not installed in adverse weather conditions.

c. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

The proper number, type, and spacing of fasteners are installed.

Materials comply with the specified requirements.

All materials are properly stored, handled and protected from moisture or other damages. Liquid components are properly mixed prior to application.

Membrane is allowed to relax prior to seaming. Adhesives are applied uniformly to both mating surfaces and checked for proper set prior to bonding mating materials. Mechanical attachments are spaced as required, including additional fastening of membrane in corner and perimeter areas as required.

Membrane is properly overlapped.

Membrane seaming is as specified and seams are hand rolled to ensure full adhesion and bond width. All seams are checked at the end of each work day.

Applied membrane is inspected and repaired as necessary prior to ballast installation.

Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths.

Installer adheres to specified and detailed application parameters.

Associated flashings and sheet metal are installed in a timely manner in accord with the specified requirements.

Ballast is within the specified weight range.

Temporary protection measures are in place at the end of each work shift.

3.7.2 Manufacturer's Inspection

Manufacturer's technical representative shall visit the site a minimum of three times during the installation for purposes of reviewing materials

installation practices and adequacy of work in place. Inspections shall occur during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion, at a minimum. Provide follow-up inspections of previously noted deficiencies or application errors as requested by the Contracting Officer. After each inspection, a report, signed by the manufacturer's technical representative shall be submitted to the Contracting Officer within 3 working days. The report shall note overall quality of work, deficiencies and any other concerns, and recommended corrective action.

3.7.3 Roof Drain Test

After completing roofing but prior to Government acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

3.8 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.9 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm thick aluminum card for exterior display. Card shall be 215 mm by 275 mm minimum. Information card shall identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --

SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2	(2003) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 308	(2002) Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot Dip Process
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 32	(2003) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 69	(2001a) Rolled Zinc
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(2003, 6th Ed) Architectural Sheet Metal Manual

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 General Requirements

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in SECTION 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION AND EXHAUST SYSTEM. Sheet metal materials related to masonry construction are specified in SECTION 04850 NONBEARING MASONRY VENEER/WOOD STUD WALLS.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Covering on flat, sloped, or curved surfaces; G

Gutters; G

Downspouts; G

Expansion joints; G

Splash pans; G

Flashing for roof drains; G

Base flashing; G

Counterflashing; G

Flashing at roof penetrations; G

Reglets; G

Scuppers; G

Copings, fascias and soffits; G

Drip edge; G

Conductor heads; G

Open valley flashing; G

Eave flashing; G

Indicate thicknesses, dimensions, fastenings and anchoring methods, expansion joints, finish system and color, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

SD-03 Product Data

Materials; G

Manufacturer's literature identifying materials, finishes and installation practices with specific locations where the item will be used in the work noted.

SD-04 Samples

Materials

Samples of materials proposed for use, upon request by the Contracting Officer.

Color Samples

Color samples for parapet cap, downspout/gutter and exposed flashings shall be submitted for approval.

Mock Ups

All sheet metalwork to be used in exterior wall construction shall be included in full scale mock up panels built as required in SECTION 04850 NON-BEARING MASONRY VENEER/WOOD STUD WALLS and SECTION 09225 STUCCO (PORTLAND CEMENT PLASTER).

SD-11 Closeout Submittals

Quality Control Plan

Submit for sheet metal work in accordance with paragraph entitled "Field Quality Control."

SD-12 LEED Documentation

Recycled Content; G
Manufacturing Plant Location; G
Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where flashing and sheet metal was produced, and percentage of flashing and sheet metal's raw materials extracted regionally in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for flashing and sheet metal products.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

1) Storage and handling of materials.

2) Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

3) Verification of compliance of materials before, during, and after installation.

4) Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

5) Shop drawings include explicit identification of coordination with other trades.

6) Sample panels are built and provided with all sheet metal work components of the wall construction as indicated.

7) Finishes are protected from damage until acceptance.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

Furnish sheet metal items in 2400 to 3000 mm lengths. Single pieces less than 2400 mm long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 300 mm legs. Provide accessories and other items essential to complete the sheet metal installation. These accessories shall be made of the same materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Concealed sheet metal items shall have mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used except as follows:

2.1.1 Exposed Sheet Metal Items

Shall be of the same material. The following items shall be considered as exposed sheet metal: gutters, including hangers and other accessories; downspouts; soffits, fascias and related trim; cap, valley, stepped, base, and eave flashings and related accessories, flashing and joints required by stucco, flashing required by metal wall.

2.1.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3 Copper, Sheet and Strip

ASTM B 370, cold-rolled temper, H 00 (standard).

2.1.4 Steel Sheet, Zinc-Coated (Galvanized)

ASTM A 653/A 653M.

2.1.4.1 Finish

Exposed exterior items of zinc-coated steel sheet shall have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Finish coating dry-film thickness shall be 0.020 to 0.033 mm 0.8 to 1.3 mils and color shall be as indicated on drawings.

2.1.5 Zinc Sheet and Strip

ASTM B 69, Type I, a minimum of 0.61 mm thick.

2.1.6 Stainless Steel

ASTM A 167, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.7 Terne-Coated Steel

Minimum of 350 by 500 mm with minimum of 18 kilogram 40 pound coating per double base box. ASTM A 308.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209M, ASTM B 209, anodized color or baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) as indicated on drawings, form alloy, and temper appropriate for use.

2.1.8.1 Alclad

When fabricated of aluminum, the following items shall be fabricated of Alclad 3003, Alclad 3004, Alclad 3005, clad on one side unless otherwise indicated.

a. Gutters, downspouts, and hangers

b. Soffits and fascias

c. Flashing

2.1.8.2 Finish

Exposed exterior sheet metal items of aluminum shall have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Finish coating dry-film thickness shall be 0.020 to 0.033 mm 0.8 to 1.3 mils, and color shall be as indicated on drawings.

2.1.9 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B 221M.

2.1.10 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.11 Polyvinyl Chloride Reglet

ASTM D 1784, Type II, Grade 1, Class 14333-D, 1.9 mm minimum thickness.

2.1.12 Bituminous Plastic Cement

ASTM D 4586, Type I.

2.1.13 Building Paper

ASTM D 226 Type I.

2.1.14 Asphalt Primer

ASTM D 41.

2.1.15 Through-Wall Flashing (at Masonry AND Stucco Walls)

Through-wall flashing for masonry is specified in Section 04850 NONBEARING MASONRY VENEER/WOOD STUD WALLS. Through wall flashing for stucco is specified in Section 09225 STUCCO (PORTLAND CEMENT PLASTER).

2.1.16 Through-Wall Flashing (at locations other than Masonry, Stucco or Metal Siding walls)

a. Electro-sheet copper not less than 0.14 kg, (5 ounces), factory coated both sides with acid- and alkali-resistant bituminous compound not less than 1.8 kg per square meter (6 ounces per square foot) or factory covered both sides with asphalt-saturated cotton fabric, asphalt saturated glass-fiber fabric, or with 18 kg reinforced kraft paper bonded with asphalt.

b. Stainless steel, Type 304, not less than 0.08 mm thick, completely encased by and permanently bonded on both sides to 23 kg high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.

c. Nonreinforced, waterproof, impermeable extruded elastomeric single ply sheeting not less than 0.76 mm (30 mils) thick.

d. 0.09 kg (Three ounce) copper sheet, with 0.05 mm (2 mils) of dense, clear, polyethylene sheet bonded to each side of the copper.

e. Use of PVC flashing systems is prohibited.

2.1.17 Louvers

Louvers are specified in SECTION: 10201 METAL WALL LOUVERS.

2.1.18 Roof Flashing

Roof flashing is specified in Section 07416 STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM for supplemental specification of roof flashing materials and installation requirements.

2.1.19 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials. Nails shall be barbed, annular thread or screw type. Stainless steel fasteners shall be used for connecting dissimilar metals, and where shown on the drawings. Fasteners used on anodized or painted sheet metal shall be colored to match.

PART 3 EXECUTION

3.1 INSTALLATION

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.1.1 Metal Roofing

Metal roofing specified in this section applies to small areas of exposure detailed and built as part of the flashing system, or as minor additions to concrete tile or membrane roofing systems. Refer to SECTION 07416 STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM for metal roof identified on drawings.

3.1.1.1 Flat Copper Roofing

Before applying roofing, cover deck with rosin-sized building paper. Lap 50 mm at joints and secure in place with roofing nails. Using solder of equal parts tin and lead, solder slowly with well-heated irons to thoroughly heat sheet and completely sweat solder through full width of seam. Tin edges of copper to be soldered at least 20 mm before sheets are locked. Use solid copper or bronze roofing nails. Where roof decks abut vertical surfaces, turn metal roofing up vertical surfaces about 200 mm where practicable; where vertical surfaces are covered with applied materials, turn up roofing behind applied materials. Use standing-seam method for roofs having rise of more than one in four, and use flat-seam method when rise is one in four or less. Walking not permitted directly on metal roofs.

3.1.1.2 Standing-seam Method

Make standing seams parallel with slope of roof. Fabricate sheets into long lengths at shop by locking short dimensions together and thoroughly soldering joints thus formed. In applying metal, turn up one edge of course at each side seam at right angles 40 mm. Then install 50 by 75 mm

inch cleats spaced 300 mm apart by fastening one end of each cleat to roof with two 25 mm long nails and folding roof end back over nail heads. Turn end adjoining turned-up side seam up over upstanding edge of course. Turn up adjoining edge of next course 45 mm and abutting upstanding edges locked, turned over, and flattened against one side of standing seam. Make standing seams straight, rounded neatly at the top edges, and stand about 25 mm above roof deck. All sheets shall be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern, as shown in SMACNA Arch. Manual.

3.1.1.3 Flat-seam Method

Lay metal so short dimension is parallel to gutter or eave lines and so water will flow over and not into seams. Make seams by turning edges of sheet 20 mm and lock and solder together. If sheets are laid one at a time, secure to roof deck with cleats, using three cleats to each sheet, two on long side and one on short side. Use cleats 50 mm wide, hooked over 20 mm upturned edges of sheets, and nail to roof deck with two 25 mm long nails. Turn back roof end of cleat over nail heads before next sheet is applied. If desired, sheets may be made into long lengths at shop by locking short dimensions together and soldering seams thus formed. Turn long lengths 20 mm, and secure each length to roof deck by cleats spaced 300 mm apart. Mallet and solder seams after pans are in place." All sheets to be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern, as shown in SMACNA Arch. Manual.

3.1.2 Workmanship

Make lines, arrises, and angles sharp and true. Free exposed surfaces from visible wave, warp, and buckle, and tool marks. Fold back exposed edges neatly to form a 13 mm hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA Arch. Manual, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.3 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 450 mm. Confine nailing of flashing to one edge only. Space nails evenly not over 75 mm on centers and approximately 13 mm from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips

required to secure the work. Sleepers and nailing strips are specified in Section 06100 ROUGH CARPENTRY.

3.1.4 Cleats

Provide cleats for sheet metal 450 mm and over in width. Space cleats evenly not over 300 mm on centers unless otherwise specified or indicated. Unless otherwise specified, cleats shall be not less than 50 mm wide by 75 mm long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry. Pretin cleats for soldered seams.

3.1.5 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Joints in aluminum sheets 1.0 mm or less in thickness shall be mechanically made.

3.1.6 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.6.1 Flat-lock Seams

Finish not less than 20 mm wide.

3.1.6.2 Lap Seams

Finish soldered seams not less than 25 mm wide. Overlap seams not soldered, not less than 75 mm.

3.1.6.3 Loose-Lock Expansion Seams

Not less than 75 mm ; provide minimum 25 mm movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 3 mm thick bed. Sealants are specified in Section 07920 JOINT SEALANTS.

3.1.6.4 Standing Seams

Not less than 25 mm high, double locked without solder.

3.1.6.5 Flat Seams

Make seams in the direction of the flow.

3.1.7 Soldering

Where soldering is specified, it shall apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Edges of

sheet metal shall be pretinned before soldering is begun. Seal the joints in aluminum sheets of one mm or less in thickness with specified sealants. Do not solder aluminum.

3.1.7.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of one mm or less in thickness with specified sealants. Do not solder aluminum.

3.1.8 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than one mm. Aluminum one mm or less in thickness shall be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.8.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2.

3.1.8.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 300 mm maximum on centers. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 50 mm from the end of the overlapping sheet.

3.1.9 Protection from Contact with Dissimilar Materials

3.1.9.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

3.1.9.2 Aluminum

Aluminum surfaces shall not directly contact other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.9.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.9.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.10 Expansion and Contraction

Expansion joints shall be provided as indicated and constructed as specified in SMACNA Arch. Manual. Provide expansion and contraction joints at not more than 9750 mm intervals for aluminum and at not more than 12000 mm intervals for other metals. Where the distance between the last expansion joint and the end of the continuous run is more than half the required interval, an additional joint shall be provided. Space joints evenly. Join extruded fascias by expansion and contraction joints spaced not more than 3600 mm apart.

3.1.11 Base Flashing

Lay the base flashings with each course of the roof covering, shingle fashion, where practicable, where sloped roofs abut chimneys, curbs, walls, or other vertical surfaces. Extend up vertical surfaces of the flashing not less than 200 mm and not less than 100 mm under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 150 mm. Overlap the flashing strips with the previously laid flashing not less than 75 mm. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 150 mm o.c. with large headed aluminum roofing nails a minimum of 50 mm lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of chimneys, curbs,and similar vertical surfaces extending through sloping roofs. Extend the metal flashings onto the roof covering not less than 115 mm at the lower side of dormer walls, chimneys, and similar vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Base flashing for interior and exterior corners shall be factory-fabricated. Metal base flashing shall not be used on built-up roofing.

3.1.12 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 230 to 250 mm above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 75 mm. Fold the exposed edges of counterflashings 13 mm. Where stepped counterflashings are required, they may be installed in short lengths a minimum 200 mm by 250 mm or may be of the preformed one-piece type. Provide end laps in counterflashings not less than 75 mm and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 3000 mm. Form the flashings to the required shapes before installation. Factory-form the corners not less than 300 mm from the angle. Secure the flashings in the reglets with lead wedges and space not more than 450 mm apart; on chimneys and short runs, place wedges closer

together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Caulking is covered in Section 07920 JOINT SEALANTS. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 6 mm and extend not less than 50 mm into the walls. Install counterflashing to provide a spring action against base flashing. Counter flashing shall be factory formed to provide spring action against the base flashing.

3.1.13 Stepped Flashing

Stepped flashing shall be installed where sloping roofs abut vertical surfaces. Separate pieces of base flashing shall be placed in tile courses. Base flashing shall be at least 100 mm wide on each leg. Stepped counterflashing shall extend at least 200 mm above roof surface. Stepped flashing shall be lapped at least 100 mm at all vertical joints. In other respects, flashing system shall be configured as directed by tile manufacturer's written installation instructions.

3.1.14 Metal Reglets

Caulked type or friction type reglets shall be factory fabricated with a minimum opening of 6 mm and a depth of 30 mm, as approved.

3.1.14.1 Caulked Reglets

Provide with rounded edges and metal strap brackets or other anchors for securing to the concrete forms. Provide reglets with a core to protect them from injury during the installation. Provide built-up mitered corner pieces for internal and external angles. Wedge the flashing in the reglets with lead wedges every 450 mm, caulked full and solid with an approved compound.

3.1.14.2 Friction Reglets

Provide with flashing receiving slots not less than 16 mm deep, 25 mm jointing tongues, and upper and lower anchoring flanges installed at 600 mm maximum snaplock receiver. Insert the flashing the full depth of the slot and lock by indentations made with a dull-pointed tool, wedges, and filled with a sealant. For friction reglets, install flashing snaplock receivers at 600 mm o.c. maximum. When the flashing has been inserted the full depth, caulk the slot and lock with wedges and fill with sealant.

3.1.15 Polyvinyl Chloride Reglets (for Temporary Construction Installation)

Rigid polyvinyl chloride reglets ASTM D 1784, Type II, Grade 1, Class 14333-D, 2 mm minimum thickness may be provided in lieu of metal reglets for temporary construction only.

3.1.16 Fascias

Prefabricate in the shapes and sizes indicated and in lengths not less than 2400 mm. Extend flange at least 100 mm onto roofing. Provide prefabricated, mitered, internal and external corners. Install fascias after all plies of the roofing membrane have been applied. Nail flange

securely to wood nailer with large-head, barbed-shank roofing nails 38 mm long spaced not more than 75 mm on centers, in two staggered rows.

3.1.16.1 Edge Strip

Hook the lower edge of fascias at least 20 mm over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 150 mm maximum on centers. Where fastening is made to concrete or masonry, use screws spaced 300 mm on centers driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 2 mm thick compatible spacer or washers.

3.1.16.2 Joints

Leave open the section ends of gravel stops and fascias 6 mm and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 100 mm set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum fascias in accordance with the manufacturer's printed instructions and details.

3.1.17 Metal Drip Edge

Provide a metal drip, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 75 mm and secure with compatible nails spaced not more than 250 mm on center along upper edge.

3.1.18 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 20 by 5 mm of material compatible with gutter. Fabricate gutters in sections not less than 2400 mm. Lap the sections a minimum of 25 mm in the direction of flow or provide with concealed splice plate 150 mm minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Aluminum gutters shall be joined with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on adjustable hangers spaced not more than 750 mm on center or by cleats spaced not less than 900 mm apart. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from metals compatible with the gutters. Gutters shall be constructed with an integral outlet tube where drainage is direct to downspouts. Outlet tube shall have a friction fit strainer removable from the gutter. Gutters that terminate at collector boxes shall have end flanges for positive connection to collector box. Expansion joints in gutters shall be constructed as indicated in SMACNA Arch. Manual.

3.1.19 Downspouts

Supports for downspouts shall be spaced according to the manufacturer's recommendation for the wood, masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 3000 mm lengths. Provide end joints to telescope not less than 13 mm and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than 25 mm away from walls. Fasten to the walls at top, bottom, and at intermediate points not to exceed 1500 mm on centers with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts. Provide downspout sampling ports at any downspouts connected to a leaching chamber.

3.1.19.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines (boots)and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Concrete splash block is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Provide splash pans as specified.

3.1.20 Flashing for Roof Drains

Roof drains are specified in Section: 15400 PLUMBING SYSTEMS. Provide a 750 mm square sheet indicated. Taper insulation to drain from 600 mm out. Set flashing on finished felts in a full bed of asphalt roof cement, ASTM D 4586. Apply strip flashing to the drain flashing. Heavily coat the drain flashing ring with asphalt roof cement. Clamp the roof membrane, flashing sheet, and stripping felt in the drain clamping ring. Secure clamps so that membrane and drain flashing are free of wrinkles and folds.

3.1.21 Scuppers and Collector Boxes

Boxes shall be shop fabricated using water-tight seaming methods for through wall overflow scuppers as recommended by the SMACNA Arch. Manual. Scupper and collector boxes shall be configured as indicated on the drawings. All edges of the installed boxes shall be sealed in accordance with SECTION 07920 JOINT SEALING after installation. Line interior of scupper openings with sheet metal. Extend the lining through and project outside of the wall to form a drip on the bottom edge and form to return not less than 25 mm against the face of the outside wall at the top and sides. Fold outside edges under 13 mm on all sides. Provide the perimeter of the lining approximately 13 mm less than the perimeter of the scupper. Join the top and sides of the lining on the roof deck side to a closure flange by a locked and soldered joint. Join the bottom edge by a locked and soldered joint to the closure flange, where required, form with a ridge to act as a gravel stop around the scupper inlet. Provide surfaces to receive the scupper lining and coat with bituminous plastic cement. Mechanically fasten joints in aluminum and seal.

3.1.22 Conductor Heads

Type indicated and fabricated of the same material as the downspouts. Set the depth of top opening equal to two-thirds of the width. Provide outlet tubes not less than 100 mm long. Flat-lock solder the seams except the mechanically fastened aluminum joints filled with a hard setting sealant. Where conductor heads are used in conjunction with scuppers, set the conductor a minimum of 50 mm wider than the scupper. Attach conductor heads to the wall with masonry fasteners, and loose-lock to provide conductor heads with screens of the same material. Securely fasten screens to the heads.

3.1.23 Splash Pans

Install splash pans where downspouts discharge on roof surfaces and at other locations as indicated. Unless otherwise shown, provide pans not less than 600 mm long by 450 mm wide with metal ribs across the bottom of the pan. Form the sides of the pan with vertical baffles not less than 25 mm high in the front, and 100 mm high in the back doubled over and formed continuous with horizontal roof flanges not less than 100 mm wide. Bend the rear flange of the pan to contour of cant strip and extend up 150 mm under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified in Roofing Section.

3.1.24 Open Valley Flashing

Provide valley flashing free of longitudinal seams, of width sufficient to extend not less than 150 mm under the roof covering on each side. Provide a 13 mm fold on each side of the valley flashing. Lap the sheets not less than 150 mm in the direction of flow and secure to roofing construction with cleats attached to the fold on each side. Nail the tops of sheets to roof sheathing. Space the cleats not more than 300 mm on centers. Provide exposed flashing not less than 100 mm in width at the top and increase 25 mm in width for each additional 2400 mm in length. Where the slope of the valley is one in 2.67 or less, or the intersecting roofs are on different slopes, provide an inverted V-joint, 25 mm high, along the centerline of the valley; and extend the edge of the valley sheets 200 mm under the roof covering on each side.

3.1.25 Eave Flashing

One piece in width, applied in 2400 to 3000 mm lengths with expansion joints spaced as specified in paragraph entitled "Expansion and Contraction." Provide a 20 mm continuous fold in the upper edge of the sheet to engage cleats spaced not more than 250 mm on centers. Locate the upper edge of flashing not less than 450 mm from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with 25 mm flat locked joints with cleats that are 250 mm on centers. Place eave flashing over underlayment and in plastic bituminous cement.

3.1.26 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 375 by 455 mm. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams and fill with sealer as recommended by aluminum manufacturer. Provide an underlayment of building paper for all sheet metal covering.

3.1.27 PARAPET CAPS (COPINGS)

Parapet caps shall be shop fabricated in the shapes and sizes indicated on the drawings. Caps shall be formed from sheet material in the gauges indicted by SMACNA Arch. Manual. Lower edges of cap flange pieces shall be folded under 20 mm and formed for a drip edge such that flanges can hook onto continuous sheet metal cleats. Caps shall be formed in sections not exceeding 3 meters in length. Sections of caps shall be joined with a minimum 40 mm high standing seam joint conforming with the SMACNA Arch. Manual. Coping corners shall be fabricated with standing seam joints on a miter. Slope caps back towards the roof as indicated on the drawings. Caps shall be installed with edges hooked over continuous cleats.

3.1.27.1 Parapet Cap Support

At contractor's option, cap support shall be fabricated of preservative treated wood per SECTION 06100: ROUGH CARPENTRY, or manufacturer's standard type chairs and cleats. Wood shall be sloped to match slope in the caps and shall provide continuous support under the caps. Manufactured parapet caps shall snap on to an anchor plate and lock into position without the use of exposed fasteners. Finished installations shall be fully weathertight.

3.1.28 Expansion Joints

Provide expansion joints for roof, wall, and floor sheet metal and flashing locations as required by manufacturer, specified or indicated. Expansion joints in continuous sheet metal shall be provided at 12000 mm intervals for copper and stainless steel and at 9700 mm intervals for aluminum. Aluminum fascias which shall have expansion joints at not more than 3600 mm spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing. Conform to the requirements of Table I.

3.1.28.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Provide counterflashing as specified in paragraph "Counterflashing," except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than 25 mm for flashing on one side of the expansion joint and be less than the width of the expansion joint plus 25 mm for flashing on the other side of the

joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.28.2 Floor and Wall Expansion Joints

Provide U-shape with extended flanges for expansion joints in concrete and masonry walls and in floor slabs. Cover plates for wall and floor joints are specified in Section 05500 MISCELLANEOUS METAL..

3.1.29 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck.

3.1.30 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 75 mm on centers. Bend the top of sleeve over and extend down into the vent pipe a minimum of 50 mm. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 100 mm roof flange in bituminous plastic cement and nailed 75 mm on centers. Extend sleeve a minimum of 200 mm above the roof deck and lapped a minimum of 75 mm by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant. Sealants are covered under Section 07920 JOINT SEALANTS.

3.1.31 Stepped Flashing

Stepped flashing shall be installed where sloping roofs membrane abut vertical brick surfaces. Separate pieces of base flashing shall be placed in alternate shingle courses.

3.2 PAINTING

Field-paint sheet metal for separation of dissimilar materials. Finish painting is specified in Section 09900 PAINTS AND COATINGS.

3.2.1 Aluminum Surfaces

Shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTS AND COATINGS.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal

surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Work not in compliance with the contract shall be promptly removed and replaced or corrected. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification that specified material is provided and installed.

c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	Copper, kilograms Per Square meter	Aluminum, mm	Stainless Steel, mm	Terne-Coated Stainless Steel, mm	Zinc-Coated Steel, mm
Building Expansion Joints					
Cover.....	4.9	0.81	0.38	0.38	0.6
Covering on minor flat, pitched or curved surfaces.....	6.125	1.02	0.46	0.46	-
Downspouts and leaders.....	4.9	0.81	0.38	0.38	0.6
Downspout clips and anchors.....	-	1.02 clip	-	-	-
	-	3.175 anchor	-	-	-
Downspout straps, 50 mm.....	14.7(a)	1.52	1.27	-	-

Conductor heads.....	4.9	0.81	0.38	0.38	-
Scupper lining.....	6.125	0.81	0.38	0.38	-
Strainers, wire diameter or gage....	4.0 gage	3.66 diameter	2.77 diameter		-
Flashings:					
Base.....	6.125	1.02	0.46	0.46	0.6
Cap (Counter-flashing)	4.9	0.81	0.38	0.38	0.5
Eave.....	4.9	-	0.38	0.38	0.6
Spandrel beam.....	3.1	-	0.25	0.25	-
Bond barrier.....	4.9	-	0.38	0.38	-
Stepped.....	4.9	0.81	0.38	0.38	-
Valley.....	4.9	0.81	0.38	0.38	-
Roof drain.....	4.9				
Pipe vent sleeve(d)					
Coping.....	4.9	-	-	-	-
Fascias:					
Extrusions.....	-	1.91	-	-	-
Sheets, smooth.....	6.125	1.27	0.46	0.46	0.6
Edge strip.....	7.35	1.27	0.635	-	-
Gutters:					
Gutter section.....	4.9	0.81	0.38	0.38	0.6
Continuous cleat.....	4.9	0.81	0.38	0.38	0.6
Hangers, dimensions.....	25 mm x 3 mm (a)	25 mm x 2 mm (c)	25 mm x one mm	-	-
Joint Cover plates... (See Table II)	4.9	0.81	0.38	0.38	0.6
Reglets (c).....	3.1	-	0.25	0.25	-
Splash pans.....	4.9	1.02	0.46	0.46	-

(a) Brass.

(b) Not used.

(c) May be polyvinyl chloride.

(d) 12.25 kilogram minimum lead sleeve with 100 mm flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vents" for optional material.

TABLE II. SHEET METAL JOINTS

TYPE OF JOINT		
Item Designa-	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and	

tion	Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	30 mm single lock, standing seam, cleated	30 mm single lock, standing	- - -
Flashings			
Base	25 mm 75 mm lap for expansion joint	25 mm flat locked, soldered; sealed; 75 mm lap for expansion joint	Aluminum producer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound compound. See Section 07920 JOINT SEALANTS.
Cap-in reglet	75 mm lap	75 mm lap	Seal groove with joint sealing compound. See Section 07920 JOINT SEALANTS.
Reglets	Butt joint	- - -	Seal reglet groove with joint sealing compound. See Section 07920 JOINT SEALANTS.
Eave	25 mm flat locked, cleated. 25 mm loose locked, sealed expansion joint, cleated	25 mm flat locked, locked, cleated 25 mm loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	75 mm lap	75 mm lap	- - -
Valley.	150 mm lap cleated	150 mm lap cleated	- - -
Edge strip	Butt	Butt	- - -
Gravel stops:			

Extrusions	- - -	Butt with 13 mm space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing backup plate.
Sheet corru-gated	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing beneath and a cover plate or a combination unit
Gutters	40 mm lap, riveted and soldered	25 mm flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.

(a) Elastomeric flashing shall have 75 mm lap with manufacturer's recommended sealant.

(b) Polyvinyl chloride reglet shall be sealed with manufacturer's recommended sealant.

-- End of Section --

SECTION 07725

FALL PROTECTION ANCHORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A 276	(2004) Stainless Steel Bars and Shapes
ASTM A 570	Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality
ASTM A 666	(2003) Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR - 1926.502	Fall Protection Systems Criteria

1.2 DESIGN REQUIREMENTS

Fall protection anchors shall be installed along roof ridges unless otherwise noted or indicated on drawings. Provide fall arrest for one person and fall restraint for up to four persons. Anchors shall be installed consistent with OSHA 29 CFR - 1926.502 requirements for permanent attachment and as indicated. Anchors and attachment to roof substructure shall have a minimum tensile strength of 22.2 kN and shall not deflect more than 1 mm under a 10kN load. Anchor shall resist impact load resulting from a 1.8 meter free fall of a 100 kg attached load. Anchorage shall incorporate an attachment point for a locking snap hook lanyard. Attachment point shall allow a cable to be strung between adjacent anchors.

Attachment point shall be at least 200 mm above adjacent roof surface and ridge flashing.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fall Protection Anchors; G

Dimensioned drawings indicating location of each anchor including details of construction, and fastening to structural frame of roof. Drawings shall indicate coordination with flashing required to keep roof penetration water tight. Drawings shall contain project specific installation instructions.

Flashing; G

Provide dimensioned drawings describing flashing required at anchors. Provide separate drawings for each type of anchor/flashing condition.

SD-07 Certificates

Fall Protection Anchors; G

Certification that anchors meet all load resistance requirements.

1.4 DELIVERY, STORAGE AND HANDLING

Fall protection anchors shall be protected from moisture and damage. Damaged items shall be removed from site.

1.5 PROJECT/SITE CONDITIONS

Mounting positions shall be field-measured, coordinated with adjacent construction and materials and recorded on shop drawings prior to fabrication. Fabrication shall be scheduled with construction schedule.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of fall protection anchors with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verification of anchor installation consistent with shop drawings.

(5) Coordination with manufacturer of Structural Insulated Panel system roof structure to ensure additional blocking members for anchor connection.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Materials, fasteners and standard articles shall conform to the requirements indicated in Section 05500 MISCELLANEOUS METAL.

2.1.1 Stainless Steel

Shall conform to the applicable sections of ASTM A 167, ASTM A 276 or ASTM A 666, Type 304 or 304L, according to use, type and shape.

2.1.2 Stainless Steel Fasteners

Shall be 300 series stainless steel and shall be used for all connections of stainless steel and also for all connections of dissimilar materials unless otherwise indicated.

2.1.3 Steel Plate

Shall conform to ASTM A 570, minimum thickness 6 mm.

2.1.4 Steel Pipe

Shall conform to ASTM A 53, schedule 80 pipe with minimum inside diameter of 60 mm.

2.2 FALL ARREST ANCHORS

Anchors shall be fabricated of steel or stainless steel and shall be assembled to provide the specified load resistance. Anchors shall be a manufacturer's standard product or shall be custom fabricated, consistent with the anchor details provide in drawings, and tested by an independent agency to demonstrate conformance with specified requirements.

2.2.1 Representative Product

Project detailing is based on the anchor model listed below. Use of approved equal (either anchor products provided by other manufacturers, or custom fabricated anchors) is acceptable. Any redesign of roof, structure

or flashing required to accommodate other anchor configurations is the responsiblity of the contractor and shall be approved by the government prior to anchor fabrication.

CB-9 Roof Anchor
Guardian Fall Protection, Inc.
26513 79th Avenue South
Kent, WA 98032
(253) 854-5877
FAX (253) 854-5980

2.3 FABRICATION

Anchors shall be fabricated in accordance with approved shop drawings. Welds and fasteners shall be clean, secure, watertight, and smooth. Edges shall be wired or beaded, where necessary, to ensure rigidity. Joints between sections shall be watertight. Design shall allow for expansion and contraction of adjacent materials. Galvanic action between different metals in direct contact shall be prevented by nonconductive separators.

2.4 FINISH

Anchors shall have a smooth finish with all exposed edges radiused to remove all sharp edges or corners. Stainless steel anchors shall be mill finish. Steel anchors shall be hot dip galvanized and painted to match the standing seam metal roof.

PART 3 EXECUTION

3.1 PREPARATION

Roof connection point sub-framing and blocking, as required to transfer loads to structural framing, shall be installed in accordance with approved shop drawings and manufacturer's recommendations and inspected prior to installation of Structural Insulated Panels (SIP). Inspect SIP that share an edge at ridges to verify that additional blocking required to support anchors is in place. SIP shall be inspected on the ground. Immediately notify Contracting Officer of any frame or roof construction requiring correction before installation of anchors. Fall protection anchors shall be installed prior to starting work on the installation of metal roofing and flashing systems. Surrounding roof surfaces shall be protected from damage at all times.

3.2 INSTALLATION

Fall protection anchor installation shall be coordinated with roofing work, and shall be installed in accordance with approved shop drawings, and manufacturer's published instructions, if a standard product is used. Install all fasteners indicated for each anchor. The installation shall be watertight. Flashing surfaces shall be protected from direct contact with incompatible materials. Do not use aluminum flashing materials. Do not install anchors unless they are complete and ready for service the same day.

3.3 PROTECTION

Exposed anchor finish surfaces shall be protected against the accumulation of grime, mastic, and sealants. Protect anchors from disfigurement, discoloration and damage for duration of construction activities. Anchors shall be used only for personal fall protection. Tie off of materials or equipment is prohibited.

-- End of Section --

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SECTION 07812

INTUMESCENT THIN FILM FIRE RESISTIVE COATING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATION OF THE WALL AND CEILING INDUSTRIES - INTERNATIONAL (AWCI)

AWCI TM 12-B	(1997) Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; An Annotated Guide

ASTM INTERNATIONAL (ASTM)

ASTM D 2240	(2003) Rubber Property - Durometer Hardness
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3960	(2002) Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D 4541	(2002) Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 736	(2000) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E 759	(1992; R 2000) Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 761	(1992; R 2000) Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

UNDERWRITERS LABORATORIES (UL)

UL 263	(2003) Fire Tests of Building Construction and Materials
UL Fire Resist Dir	(2004) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire Resistive Coating Material; G,

Data identifying performance characteristics of fire resistive material. Data shall include recommended application requirements and indicate thickness of coating that must be applied to achieve each required fire rating.

SD-04 Samples

Fire Resistive Coating; G,

One sample panel, 450 mm square, for each specified type of coating. Also, a designated sample area of not less than 9 square meters shall be prepared. Sample area shall be representative of typical installation of fire resistive coating including metal decks, beams, columns and attachments. Equipment, materials and procedures used in the sample area shall be the same as, or representative of, that to be used in the work. The sample area shall be approved prior to proceeding with coating work in any other area. The approved sample area shall be used as a reference standard for applied fire resistive material. Sample area shall remain in place and open to observation until all coating is completed and accepted, at which time it may become part of the work.

SD-06 Test Reports

Fire Resistance Rating; G,

Reports and test records, attesting that the fire resistive coating material conforms to the specified requirements. Each test report shall conform to the report requirements specified by the test method.

Field Tests; G

Test reports documenting results of tests on the applied material in the project. Report shall include defects identified, repair procedures, and results of the retests when required.

SD-07 Certificates

Installer Qualifications; G,

Manufacturer's certification that each listed installer is qualified and trained to install the specified fire resistive coating. Evidence that each fire resistive coating installer has had a minimum of 3 years experience in installing the specified type of fire resistive coating on steel.

Surface Preparation Report; G

Manufacturer's certification that surfaces to be protected have been inspected and are acceptable to receive fire resistive coating. The statement shall list the structural members and the areas that have been inspected and certified.

Manufacturer's Inspection Report; G

Manufacturer's certification that the fire resistive coating in the entire project complies with the manufacturer's criteria and recommendations.

1.3 DELIVERY AND STORAGE

Packaged material shall be delivered in the original unopened containers, marked to show the brand name, the manufacturer, and the UL markings. Fire resistive coating material shall be kept dry until ready to be used, and shall be stored off the ground, under cover and away from damp surfaces. Storage area shall have temperature controlled between 10 degrees C and 38 degrees C. No direct sunlight exposure. Damaged or opened containers will be rejected. Material with shelf-life shall be applied prior to expiration of the shelf-life.

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

Substrate and ambient air temperatures shall be maintained above 10 degrees C during application and for 72 hours before and after application. Relative humidity during application and curing period shall be maintained within the limits recommended by the fire resistive coating manufacturer.

1.4.2 Ventilation

Adequate ventilation shall be provided to properly dry the fire resistive coating after application. In enclosed areas, a minimum of 4 air exchanges

per hour shall be provided by forced air circulation.

1.5 INSTALLER QUALIFICATIONS

Engage an experienced installer that is certified, licensed, or otherwise qualified by the fire resistive coating manufacturer as having the necessary experience, staff, and training to install the manufacturer's products in accordance with specified requirements. Each installer of fire resistive coating material shall be trained, have a minimum of 3 years experience and a minimum of three installations using fire resistive coating of the type specified. A manufacturer's willingness to sell its products to the Contractor or installer does not infer qualification of the buyer.

1.6 MANUFACTURER'S SERVICES

The manufacturer or its representative shall be onsite prior to, and at completion of the application, to provide the specified inspections and certifications; and to ensure that preparations are adequate and that the material is applied according to manufacturer's recommendations and the contract requirements.

1.7 FIRE RESISTANCE RATING

Fire resistance ratings shall be in accordance with the fire rated assemblies listed in UL Fire Resist Dir. Proposed materials not listed in UL Fire Resist Dir shall have fire resistance ratings at least equal to the UL Fire Resist Dir ratings as determined by an approved independent testing laboratory, based on tests specified in UL 263 or ASTM E 119. Fire resistive coating shall be applied to structural steel members, to achieve the following hourly fire resistance ratings and in accordance with the following UL design or approved equivalent. Hourly ratings indicated are independent of resistance provided by surrounding gypsum wallboard surfaces. Use unrestrained fire resistance ratings, unless the drawings indicate that the degree of thermal restraint of the construction meets or exceeds the degree of thermal restraint of the tested assembly. Performance tests shall be in accordance with ASTM E 119.

Fire Rating Schedule - Additional Fire Resistance Provided by Coating

Element	Hourly Rating	UL Design Reference
Columns supporting one floor	1	X 642, X 648
Columns supporting roof	1	X 642, X 648
Floor decks	2	D 902, D 941
Floor supports	2	D 902, D 941

Fire Rating Schedule - Additional Fire Resistance Provided by Coating

Element	Hourly Rating	UL Design Reference

1.8 EXTENT OF FIRE RESISTIVE COATING

All structural steel, and undersides of steel floors shall be protected with fire resistive coating to a fire resistance hour-rating as indicated in the preceding paragraph, unless otherwise indicated.

1.9 PRE-INSTALLATION CONFERENCE

The Contractor shall hold a meeting with the installer, field testing agency, the manufacturer, subcontractors (whose employees come into contact with the fire resistive coating), and the Contracting Officer prior to the installation of any fire resistive coating material to review the substrates for acceptability, method of application, applied thickness, patching, repair, inspection and testing procedures.

PART 2 PRODUCTS

2.1 FIRE RESISTIVE COATING

Fire resistive coating material, including primers, basecoat, mastic and top coat shall be the manufacturer's standard, water based, intumescent fire resistive coating system. Material shall be asbestos free, low VOC consistent with ASTM D 3960, and intended for application to the steel materials indicated. Material shall have a Class A rating with flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84.

2.1.1 Cohesion/Adhesion

Fire resistive coating shall have minimum ASTM E 736 cohesion/adhesion of 400 kPa.

2.1.2 Deflection

Fire resistive coating shall not crack, spall, or delaminate when backing to which it is applied is subject to downward deflection 1/120 of 3 m clear span, when tested in accordance with ASTM E 759.

2.1.3 Bond-Strength

Fire resistive coating material shall not crack, spall or delaminate and shall have a minimum strength of 1 MPa when tested in accordance with ASTM D 4541.

2.1.4 Compressive Strength

The minimum compressive strength shall be 3.0 MPa when tested in accordance with ASTM E 761.

2.1.5 Impact Resistance

Provide minimum resistance of 0.5 kg-m at 65 mils in accordance with ASTM D 2794.

2.1.6 Durometer Hardness

Provide minimum hardness of 80 (Shore D in accordance with ASTM D 2240.

2.2 Top Coat

Top coat, if required by system, shall be the type approved by the manufacturer of the fire resistive coating material, shall be resistant to mold, mildew and fungus, shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84, and shall be a contrasting color to base coat.

2.3 WATER

Water used for material mixing and surface preparation shall be potable.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be coated shall be thoroughly cleaned of dirt, grease, oil, paint, primers, loose rust, rolling lubricant, mill scale or other contaminants that will interfere with the proper bonding of the fire resistive coating to the substrate. Prepare consistent with SSPC surface preparation standard recommended by manufacturer. Painted/primed steel substrates shall be tested in accordance with ASTM E 736, with specified sprayed fire resistive coating material, to provide the required fire-resistance rating; painted or primed steel surfaces may require a fire resistive coating bond test to determine if the paint formulation will impair proper adhesion. The Contractor shall certify the acceptability of surfaces to receive fire resistive coating and submit a Surface Preparation Report accordingly. Overhead areas to be coated shall be cleared of all obstructions interfering with the uniform application of the fire resistive coating. Hardware such as support sleeves, inserts, clips, hanger attachment devices and the like shall be installed prior to the application of the fire resistive coating. Condition of the surfaces shall be acceptable to the manufacturer prior to application of fire resistive coating. Applications listed for use on primed surfaces shall be in accordance with the manufacturer's recommendations and standards, and detailed in submittal item SD-03 Product Data.

3.2 PROTECTION

Surfaces not to receive fire resistive coating shall be completely masked and covered to prevent contamination by splatter, rebound and overspray. Protect all concrete floor surfaces. Exterior openings in areas to receive fire resistive coating shall be covered prior to and during application of fire resistive coating with tarpaulins or other approved material. Surfaces not to receive fire resistive coating shall be cleaned of fire

resistive coating.

3.3 MIXING

Fire resistive coating material shall be mixed in accordance with the manufacturer's recommendations.

3.4 APPLICATION

3.4.1 Sequence

Prior to application of fire resistive coating, the manufacturer shall inspect and approve application equipment, water supply and pressure, and the application procedures. Fire resistive coating required to be applied to underside of steel floor assemblies, shall be applied only after floor construction is complete. No floor traffic shall be allowed during application and during the manufacturer's minimum curing period. Fire resistive coating material shall be applied prior to the installation of ductwork, piping and conduits which would interfere with uniform application of the fire resistive coating.

3.4.2 Application Technique

Application technique used shall be consistent with manufacturer's recommendations throughout the fire resistive coating application. Use only one application technique. Fire resistive coating material shall be applied to the thickness and density established for the specified fire resistance rating, in accordance with the procedure recommended by the manufacturer, and to a uniform density and texture. Carefully adhere to manufacturer's recommendations for intra coat drying times.

3.4.3 Top Coat Application

If top coat is required by the product used, it shall be applied after field testing has been conducted and after corrective measures and repairs, if required, have been completed.

3.4.4 Applied Thickness

The minimum thickness shall be no less than the specific requirement dictated by coating system, substrate and hourly resistance rating indicated. Applicator shall verify coating adequacy during application with Wet Film thickness checks. Follow manufacturer's recommendations for minimum and maximum coat thicknesses.

3.5 FIELD TESTS

At the option of the contracting officer, the applied fire resistive coating shall be tested by an approved independent testing laboratory and paid for by the Contractor. Testing shall follow the methodology described in AWCI TM 12-B. The tests shall be performed in approved locations for cohesion/adhesion in accordance with ASTM E 736, and for thickness in accordance with the approved UL design. Testing shall verify continuity and coverage of the coating. At least two test samples shall be located

for each column, beam and deck substrate type. Any area showing less than minimum requirements shall be corrected. Proposed corrective measures, in writing, shall be approved before starting the corrective action. Corrected work shall be retested.

3.5.1 Structural Components

Each structural component type shall be tested at floor and roof decks, beams, and columns. Minimum thickness shall be as required by UL Fire Resist Dir. Cohesion/adhesion, impact resistance and hardness shall be as specified.

3.5.2 Repair

Additional fire resistive coating material may be added to provide proper thickness. Rejected areas of fire resistive coating shall be corrected to meet specified requirements by adding fire resistive coating material to provide the proper thickness, or by removing defects and respraying with new fire resistive coating material. Repairs shall use same type of fire resistive coating material as originally applied or patching materials recommended by the manufacturer. Repaired areas shall be retested and reinspected. fire resistive coating material shall be applied to voids or damaged areas by hand-trowel, or by respraying.

3.5.3 Visual Inspections

On going inspections shall be made consistent with AWCI TM 12-B. Inspections shall be made by the certified independent laboratory prior to closure of concealed areas. These inspections may be phased, but shall not occur less than 5 working days prior to the enclosure of the fire resistive coating. Sprayed areas shall receive a final inspection. Fireproofed surfaces shall be inspected after mechanical, electrical, and other work in contact with fire resistive coating material has been completed and before sprayed material is covered. Any locations missing fire resistive coating shall be patched in accordance with the manufacturer's requirements.

3.5.4 Manufacturer's Inspection

The manufacturer shall inspect the fire resistive coating work after the work is completed in each area, including testing, repair and clean-up, and shall certify that the work complies with the manufacturer's criteria and recommendations. Before the sprayed material is covered, and after all of the fire resistive coating work is completed, including repair, testing, and clean-up; and after mechanical, electrical and other work in contact with fire resistive coating material has been completed, the manufacturer shall re-inspect the work and certify that the entire project complies with the manufacturer's criteria and recommendations. The Contractor shall obtain and submit the Manufacturer's Inspection Report and certifications of approval.

3.5.5 Patching

Patching and repairing of damaged fire resistive coating is the responsibility of the Contractor. The patching material shall be the same

as that specified for that area.

3.6 CLEANUP

Surfaces not indicated to receive fire resistive coating shall be thoroughly cleaned of sprayed material within a 24 hour period after application.

-- End of Section --

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SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 1399	(1997; R 2000) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E 1966	(2001) Fire-Resistive Joint Systems
ASTM E 814	(2002) Fire Tests of Through-Penetration Fire Stops
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM Standard 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003) Fire Tests of Through-Penetration Firestops
UL 2079	(1998) Tests for Fire Resistance of Building Joint Systems
UL 723	(2003) Test for Surface Burning Characteristics of Building Materials
UL Fire Resist Dir	(2004) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials; G.

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" and "T" ratings, and type of application.

SD-07 Certificates

Firestopping Materials; G.

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications.

Documentation of training and experience.

Inspection; G.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction

joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above. Products and installation shall comply with firestopping requirements of the International Building Code (2003).

1.4 DELIVERY AND STORAGE

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is:

a. FM Research approved in accordance with FM Standard 4991, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

1.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of firestopping with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Inspection of all firestopping installations during application.

(5) Aesthetic coordination of firestopping with adjacent finishes.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall be commercially manufactured, asbestos-free, contain no water soluble intumescent ingredients, be noncombustible products FM P7825a approved for use with applicable construction and penetrating items, and comply with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application or during fire conditions.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resist Dir listed or FM P7825a approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected, except that "F" rating may be 3 hours in through-penetrations of 4 hour fire rated wall or floor. Firestop systems shall also have "T" rating where required.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

a. Penetrations of Fire Resistance Rated Walls and Partitions:
F Rating = Rating of wall or partition being penetrated.

b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = one hour, T Rating = one hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Surfaces shall be prepared as recommended by the manufacturer.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products that do not cure over time. Firestopping shall be modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, adds or changes without the need to remove or replace any firestop materials.

3.2.4 Compatibility with Finishes

Firestopping materials shall be flush with adjacent surfaces in all areas exposed to view. Where a finish material is applied over the firestopping, care shall be taken to ensure that the firestopping does not affect the plumb/flush surface or adhesion to substrate, of the finish material. Where an escutcheon or cover plate covers a penetration, the firestopping material shall be completely concealed by the cover.

3.3 INSPECTION

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. The Contractor shall submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

-- End of Section --

SECTION 07920

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(2000) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(2001) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 919	(2002) Use of Sealants in Acoustical Applications
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1056	(2000) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 217	(2002) Cone Penetration of Lubricating Grease
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

BAY AREA (California) AIR QUALITY MANAGEMENT DISTRICT REGULATION

BAAQMD Regulation 8, Rule 51	(2003) Adhesives and Sealant Products

South Coast Air Quality Management District (SCAQMD)

SCAQMD Rule #1168	(2003) Adhesive and Sealant Applications

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G

Include color samples of sealants used in brick veneer and stucco finishes.

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant; G

Certificates of compliance stating that the materials conform to the specified requirements.

SD-12 LEED Documentation

VOC Emissions; G

Manufacturer's statement of VOC emissions for sealants in accordance with LEED-NC RG.

1.3 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 4 and 32 degrees C when sealant is applied. Do not proceed with installation of sealants under adverse weather condition, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external

shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Elastomeric sealant containers shall be labeled to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 32 degrees C or less than 4 degrees C.

1.5 TEST JOINTS

For all joints exposed to view in the finished construction, a test joint shall be prepared in the actual erected system (or in a test panel mock up where required). Joint shall be prepared complete with all materials as indicated and specified. After a minimum of 24 hours cure time, the joint shall be inspected by the Contracting Officer's Representative. Inspection shall consider color uniformity and conformance to adjacent material(s), uniformity of tooling, depth of joint and surface finish. Test joints passing inspection shall remain in the finished construction. Any joint materials failing inspection shall be removed and reinstalled. Color alone shall be cause for rejection.

1.6 PROJECT CONDITIONS

1.6.1 Pre-installation Meeting

At the Contractor's direction, the installer, Contract Officer's Representative, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with the Contractor at the project site to review the procedures and time schedule proposed for installation of sealants in coordination with other work.

1.6.2 Conditions of other Work

The contractor and installer shall examine the joint surfaces, backing and anchorage of units forming sealant rabbet, and the conditions under which the sealant work is to be performed, and identify any conditions detrimental to the proper and timely completion of the work and performance of the sealants. Do not proceed with the sealant work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

1.6.3 Warranty

Repair or replace elastomeric sealants which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion or abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance or general durability.

1.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of joint sealing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Sample panels of exterior wall construction include representative sealant joints.

(5) Verification that correct sealant colors are used in all exposed locations.

(6) Protection of sealant materials after installation from contamination by any source, including wind blown dust and debris.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

Products shall conform to the respective specifications and other requirements specified. Each container brought to the jobsite with a different sealant formulation shall be marked for the intended use. General properties shall be as follows:

Hardness: As recommended by the manufacturer for application shown, unless otherwise indicated.

Modulus of Elasticity: Provide the lowest available modulus of elasticity which is consistent with exposure to weathering, indentation, vandalism, abrasion, support of loading, and other requirements.

Compatibility: Before purchase of each required material, confirm its compatibility with each other material it will be exposed to in the joint system.

Size and Shape: As shown, or if not shown, as recommended by the manufacturer for the type and condition of joint and for the indicated joint performance or movement.

Grade of Sealant: For each application, unless otherwise indicated, provide the grade of sealant (non-sag, self-leveling, no-track, knife grade, preformed, etc.) as recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions) to achieve the best possible overall performance.

Grades specified herein are for normal conditions for installation.

Where sealant of this section contacts sealants in other SECTIONS, confirm compatibility between sealants and among contacting surfaces to the satisfaction of the Contracting Officers Representative.

VOC content of sealants must be less than the current VOC limits of SCAQMD Rule #1168. Sealants used as filler shall met the BAAQMD Regulation 8, Rule 51.

2.1.1 Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	Match wall color
b.	Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	Match wall color
c.	Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	Match adjoining surface color.
d.	Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match tile color
e.	Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Paint to match adj.
f.	Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.	Match grout color
g.	Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match grout color
h.	Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	White

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920,

Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b.	Joints between new and existing exterior masonry walls.	n/a
c.	Masonry joints where shelf angles occur.	Match mortar color
d.	Joints in wash surfaces of stonework.	n/a
e.	Expansion and control joints (Brick). Expansion and control joints (stucco)	Match veneer color Match stucco color
f.	Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	Match adjacent surface color
g.	Voids where items pass through exterior walls.	Match adjacent surface color
h.	Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match flashing color
i.	Metal-to-metal joints where sealant is indicated or specified.	Match metal color
j.	Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match flashing color

2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Location(s) and color(s) of sealant shall be as follows:

	LOCATION	COLOR
a.	Seats of metal thresholds for exterior doors.	Gray
b.	Control and expansion joints in floors, slabs, ceramic tile, and walkways.	as selected or indicated

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C 919 shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

2.1.5 Preformed Sealant

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C , the sealant shall be non-bleeding and shall have no loss of adhesion.

2.1.5.1 Tape

Tape sealant shall have cross-sectional dimensions as necessary to completely seal the joint, yet remain concealed below finished surfaces.

2.1.5.2 Bead

Bead sealant shall have cross-section dimensions as necessary to completely seal the joint, yet remain concealed below finished surfaces.

2.1.5.2 Foam Strip

Foam strip shall be polyurethane foam; cross-section dimensions shall be as required by joint. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C. Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A , Grade and cross section as appropriate to the application.

2.4.2 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

2.4.3 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

2.5 CAULKING

For interior applications only, oil- and resin-based caulking shall be ASTM C 570, Type I, use only at joints where no movement will occur.

2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces that have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating, unless testing has demonstrated that sealant bond is not impaired by coating or treatment.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or

bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.4 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified. Clean joint surfaces as recommended by sealant manufacturer. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

3.3.1 Joint Width-To-Depth Ratios

The joint shapes and sizes shall be as indicated on the drawings and specified herein. Joints to be caulked or sealed include but are not necessarily limited to through-bolt holes, windows and window frames, door frames, storefront frames, louver and ventilator frames, framing flashing and openings where items pass through exterior walls or roofs, joints between pre-cast concrete, cast-in-place concrete, brick or combinations of these surfaces and as otherwise indicated or necessary for watertightness, weatherproofing, or airtightness. Use sealing compound at both exterior and interior surfaces of exterior wall penetrations.

a. Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
6 mm (minimum)	6 mm	6 mm

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
over 6 mm	1/2 of width	Equal to width
For wood, concrete or masonry:		
6 mm (minimum)	6 mm	6 mm
Over 6 mm to 13 mm	6 mm	Equal to width
Over 13 mm to 50 mm	50 mm	16 mm
Over 50 mm	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding shall not be required on metal surfaces.

3.3.2 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios."

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking

bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3.7 Acoustic Sealant

Acoustical sealant shall be applied to all perimeters at sound rated walls and all penetrations through sound rated walls. Acoustical sealant shall be applied only to concealed surfaces. A full bead shall be gunned into seams, joints or openings. Piping and backs of electrical boxes shall be covered with a sealant and perimeters sealed.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

3.5 CURE AND PROTECTION

Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner that would significantly alter materials modulus of elasticity or other characteristics. Installer shall advise Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that they shall be without deterioration or damage (other than normal wear and weathering).

3.6 TEST FOR PERFORMANCE

After nominal cure of exterior joint sealants that are exposed to weather, test for water leaks. Flood joint exposure with water directed from a hose held perpendicular to the wall face, 600 mm from joint, connected to a water system with 30 psi minimum static water pressure at the nozzle. Move stream of water along joint at an approximate rate of 7 meters per minute. Test approximately 5 percent of the total joint system, in locations that are typical of every joint condition and that can be inspected for leakage on the opposite face. Conduct test in presence of the Contracting Officer's Representative who will determine actual percentage of joints to be tested and actual period of exposure to water, based on extent of observed leakage, or lack thereof. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.

Where nature of observed leakage indicates possibility of inadequate joint bond strength, Contracting Officer will direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures, and returned to the lowest range of temperature in which it is feasible to conduct testing. Repair or replace work as required. Perform testing at a reasonable time within 12 months of installation date, as directed.

-- End of Section --

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.6	(1997) Hardware on Steel Doors (Reinforcement - Application)

ASTM INTERNATIONAL (ASTM)

ASTM A 591	(1998) Steel Sheet, Electrolytic Zinc-Coated, for Light
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 59/C 59M1	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM D 2863	(2000) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A115	(Set - Spec dates Vary) Steel Preparation Standards (Incl A115.1 (1990), A115.2 (1987), A115.4 (1994), A115.5 (1992), A115.6 (1993), A115.12 (1994), A115.13 (1991), A115.14 (1994), A115.15 (1994),

	A115.16 (1990), A115.17 (1994), A115.18 (1994)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA HMM	(1999) Hollow Metal Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2003) Installation of Smoke Door Assemblies
NFPA 252	(2003) Fire Tests of Door Assemblies
NFPA 80	(1999) Fire Doors and Fire Windows

STEEL DOOR INSTITUTE (SDI)

SDI 105	(2001) Recommended Erection Instructions for Steel Frames
SDI 111-C	(2000) Recommended Louver Details for Standard Steel Doors
SDI 111-F	(2000) Recommended Existing Wall Anchors for Standard Steel Doors and Frames
SDI 113	(2001) Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI A250.8	(2003) Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10B	(1997; Rev thru Oct 2001) Fire Tests of Door Assemblies

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Frames; G

Accessories

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors; G

Schedule of frames; G

Submit door and frame locations.

SD-03 Product Data

Doors; G

Frames; G

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI A250.8 requirements.

SD-04 Samples

Factory-applied enamel finish; G

Where colors are not indicated, submit manufacturer's standard colors and patterns for selection.

SD-05 Design Data

Calculations or test reports; G

Submit calculations or test reports demonstrating that frames, mullions, glazing hardware and frame anchors meet design load requirements specified for antiterrorism standards. Calculations shall be signed by a licensed engineer. Test reports shall be provided by a nationally recognized testing agency.

SD-07 Certificates

Doors and Frames; G

Certification of Oversized Fire Doors: Certificates of inspection shall be in accordance with the requirements of NFPA 80 for fire doors exceeding the sizes for which label service is available.

Certification of Sound Rating: Certification or test report for sound rated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

Certification of Thermal Insulating: Certification or test report for thermal insulated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where steel doors and frames were produced, and percentage of steel doors and frames raw materials extracted regionally in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for steel door and frame products.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new. Do not use non-vented shelters that will promote corrosion. Doors and assembled frames shall be stored in an upright position. Doors and frames with abraded, scarred or rusty areas shall be cleaned and touched up with the paint used for shop priming/painting. Replace doors and frames with dents, creases and similar surface distortion with new materials.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of installed doors and frames with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Observation of environmental conditions and condition of adjacent construction and finishes.

(2) Protection of all materials during on site storage.

(3) Verification of compliance of materials with specification before, during and after installation.

(4) Verification/protection of labeling on all fire rated doors and frames.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in Section 08710 DOOR HARDWARE. Undercut where indicated. All doors shall have flush end closures at top and bottom. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated. Tolerances for doors and frames shall be uniform within 2 mm for edges and openings and 2 mm for flatness on diagonals. All doors shall have a minimum sound transmission classification of 28. All doors shall have a minimum insulation "R" factor of 2.5.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Standard Duty Doors

SDI A250.8, Level 1, physical performance Level C, Model 2 (seamless), of size(s) and design(s) indicated and core construction as required by the manufacturer. Provide only at closet doors.

2.1.1.2 Heavy Duty Doors

SDI A250.8, Level 2, physical performance Level B, Model 2 (seamless), with core construction as required by the manufacturer, for interior doors only, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level II at interior doors except for Extra Heavy Duty locations indicated below.

2.1.1.3 Extra Heavy Duty Doors

SDI A250.8, Level 3, physical performance Level A, Model 2 (seamless) with core construction as required by the manufacturer for interior doors and exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Minimum sound transmission class (STC) of door assemblies at corridors and at any wall type with an indicated STC requirement shall be 35. Provide Level 3 at the following locations:

a. Interior doors dividing corridors.
b. Storage rooms.

2.1.1.4 Maximum Duty Doors

SDI A250.8, Level 4, physical performance Level A, Model 2 (seamless) with core construction as required by the manufacturer, of size(s) and design(s) indicated. Provide Level 4 at insulated hollow metal exterior doors.

2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where non-standard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages, and finish shall be as specified for standard steel doors and shall comply with the requirements of NAAMM HMMA HMM. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 1.5 mm thick. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08710 DOOR HARDWARE. Undercut doors where indicated. Doors shall be 44.5 mm thick, unless otherwise indicated.

2.3 SOUND RATED STEEL DOORS

Doors shall be of the sound classification scheduled. Conform to SDI 114, except as specified otherwise. Assemblies shall consist of door, frame, and adjustable perimeter seal. The assembly shall have a Sound Transmission Class rating as specified or indicated on drawings when tested in accordance with ASTM E 90.

2.4 ACCESSORIES

2.4.1 Louvers

Louvers shall not be installed in exterior doors at any location.

2.4.1.1 Interior Louvers

SDI 111-C, Louvers shall be stationary sightproof type where scheduled. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 0.9 mm thick steel and louver blades of a minimum 0.6 mm. Sightproof louvers

to be inverted "V" blade design with minimum 55 percent net-free opening. Louvers shall not be installed in doors in corridor walls and fire rated walls.

2.4.2 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08710 DOOR HARDWARE, provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies, unless scheduled otherwise.

2.4.3 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.5 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI 113 and shall conform to:

a. Rigid Polyurethane Foam: ASTM C 59/C 59M1, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or

b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or

c. Mineral board: ASTM C 612, Type I.

2.6 STANDARD STEEL FRAMES

SDI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.6.1 Antiterrorism Standards

Exterior frames, mullions, and glazing hardware shall be designed to resist equivalent static design loads of 7 kilopascals applied to the surface of the door or glazing. Frame and mullion deformations shall not exceed 1/60 of the unsupported member lengths. The Contractor must demonstrate by calculations or tests that the frame assembly complies with the loading requirement.

Equivalent static design loads for connections of frames to the surrounding walls or hardware and associated connections, and glazing stop connections shall be 75 kilopascals for glazing panels with a vision area less than or

equal to 1.0 square meter and 30 kilopascals for glazing panels with a vision area greater than 1.0 square meter but less than or equal to 3.0 square meters.

2.6.2 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. All exterior frames shall be 14 gage, hot dip galvanized.

2.6.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and shall member with heads and jambs butt-welded thereto. Bottom of door mullions shall have adjustable floor anchors and spreader connections. At exterior locations and as indicated, mullions and transom bars shall be fabricated with minimum 25 mm deep glazing stops to meet force protection requirements for glazing as specified in paragraph 2.6.1 "antiterrorism standards".

2.6.4 Stops and Beads

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners. At exterior locations coordinate size of stops to provide 25 mm minimum glazing "bite" depth.

2.6.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.6.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick.

2.6.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 5 mm diameter steel wire, adjustable or T-shaped.

b. Stud partitions: Securely fasten anchors to backs of frames. Design anchors to be fastened through the number of studs indicated at each jamb.

c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111-F.

2.6.6.2 Floor Anchors

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs. Coordinate depth of materials such as terrazzo and ceramic tile installed on concrete slabs.

2.6.6.3 Anchors for Antiterrorism Compliance

Connections for door and mullion frames at exterior locations and locations as indicated shall be by means of threaded machine bolts through U.L.-approved pipe spacers. Bolts shall be fastened to adjacent structural steel members that have been tapped and threaded at appropriate locations. The type, size and number of bolts used shall be as required to meet connection design loading criteria as specified in paragraph 2.6.1 "Antiterrorism Standards".

2.7 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.7.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted. Protect labels with barrier tape or film until all painting has concluded, then remove barrier.

2.7.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.7.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

2.7.4 Temperature Rate of Rise Doors

Fire door assemblies located in exit enclosures shall have a maximum transmitted temperature end point of not more than 450 degrees F above

ambient at the end of 30 minutes of standard fire test exposure. Door labels on rate of rise doors shall indicate conformance.

2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI A250.8 and ANSI A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or soundproof gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI A250.8., or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames and toilet, shower and janitor room doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The coating weight shall meet or exceed the minimum requirements for coatings having 122 grams per square meter, total both sides, i.e., ZF120. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI A250.8.

2.9.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI A250.8.

2.9.4 Painting

Field painting of doors and frames shall be as specified in SECTION 09900 PAINTS and COATINGS. During painting of doors and frames, fire rating labels shall be protected at all times.

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp,

and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Coordinate door frame sections for use with the wall construction and thickness indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. All frames shall be grouted. Backfill exterior frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly.

Remove mastic smears and other unsightly marks.

3.4 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

PRODUCTS	INCH-POUND	METRIC
Door thickness	1 3/4 inches	44.5 mm
Steel channels	16 gage	1.5 mm
Steel Sheet	23 gage	0.7 mm
	16 gage	1.5 mm
	20 gage	0.9 mm
	18 gage	1.2 mm
Anchor bolts	3/8 inches	10 mm

-- End of Section --

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM E 283	(1991; R 1999) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than the design wind load indicated with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 1.25 mm nominal thickness. Components and structural attachment shall be designed to resist lateral and uplift seismic forces consistent with Army TI-809-04 (seismic use group: 1, short period spectral acceleration: 125% G, one second period spectral acceleration: 40% G, site class: D).

1.2.2 Air Infiltration

When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63 by 10-5 cms per square meter of fixed area at a test pressure of 0.30 kPa (80 kilometers per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa of fixed area.

1.2.4 Thermal Movement

Provide and make allowances for the noiseless contraction and expansion of all components and materials, over an ambient temperature range of 60 degrees C without buckling, opening of joints, glass breakage, undue stress on fasteners, or any detrimental effects to the storefront assemblies, related components and adjacent structural and/or building elements.

1.2.5 Wind Load Deflection/Building Movement

The deflection of any metal framing member in a direction normal to the plane of the framing system shall not exceed 1/175 of its clear span, or 19 mm, whichever is less. The maximum deflection of any section in the plane of the glass shall not exceed 6 mm. In the plane of the framing system, deflection of framing members shall not reduce the glass or panel bit below 75 percent of the design dimension and shall not reduce the glass or panel edge clearance below 25 percent of the design dimension or 3 mm, whichever is greater. Restrict deflection further if required for assembly and fit of components. At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 1.5 mm. Where connection points are not clearly defined, maximum anchor deflections shall not exceed 1.5 mm.

1.2.6 Antiterrorism Standards

Exterior frames, mullions, and glazing hardware shall be designed to resist equivalent static design loads of 7 kilopascals applied to the surface of the door or glazing. Frame and mullion deformations shall not exceed 1/60 of the unsupported member lengths. The Contractor must demonstrate by calculations or tests that the frame assembly complies with the loading requirement.

Equivalent static design loads for connections of frames to the surrounding walls or hardware and associated connections, and glazing stop connections shall be 75 kilopascals for glazing panels with a vision area less than or equal to 1.0 square meter and 30 kilopascals for glazing panels with a vision area greater than 1.0 square meter but less than or equal to 3.0 square meters.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors and frames; G

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

SD-03 Product Data

Doors; G

Frames; G

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

SD-05 Design Data

Calculations or test reports; G

Submit calculations or test reports demonstrating that frames, mullions, glazing hardware and frame anchors meet design load requirements specified for antiterrorism standards. Calculations shall be signed by a licensed engineer. Test reports shall be provided by a nationally recognized testing agency.

SD-08 Manufacturer's Instructions

Doors and frames

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing

plant where aluminum doors and frames were produced, and percentage of aluminum doors and frame's raw materials extracted regionally in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for aluminum door and frame products.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of aluminum doors and frames with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members, subframes, transoms, adjoining sidelights, trim, and accessories.

2.2 MATERIALS

2.2.1 Anchors

Stainless steel.

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames

ASTM B 221M, Alloy 6063-T5 for extrusions. ASTM B 209M, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners

Hard aluminum or stainless steel. Screws, nuts, bolts, rivets and other miscellaneous fastening devices incorporated in the door and frame units shall be of aluminum, nonmagnetic stainless steel, or other non-corrosive materials compatible with aluminum and shall be of sufficient strength to perform the functions for which they are used. Do not use exposed fasteners, except where unavoidable and approved. Exposed fasteners, if permitted, shall match the finish of the aluminum surfaces to which applied. Provide galvanic separation between any contacting dissimilar materials.

2.2.5 Structural Steel

ASTM A 36/A 36M.

2.2.6 Aluminum Paint

Type as recommended by aluminum door manufacturer.

2.2.7 Sealant

Conform to SECTION 07920 JOINT SEALING.

2.2.8 Separators

Dissimilar metals and dynamic connections shall have contact surfaces separated with high-impact polystyrene or nylon materials with smooth surfaces on both sides and a minimum thickness of 0.8 mm. Dynamic connections shall be a minimum of 1.5 mm thickness.

2.2.9 Glass and Glazing

Conform to SECTION 08800 GLASS AND GLAZING.

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Coordinate size of stops to provide minimum 25 mm depth "bite" for

glazing. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 300 mm o.c. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically. Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish, but not less than 151 MPa ultimate tensile strength and not less than 3 mm thickness, except tubular shapes shall have a combined wall thickness of 5 mm at any location for framing members. Heavier material shall be used if required for strength or fabrication purposes. Alloy and temper shall be such to properly receive the specified finish. Framing sections shall accommodate the glass thickness, gaskets, flashing, sealants, aluminum panels, reinforcing and connected components. Unless indicated otherwise, framing shall be fabricated for inside glazing.

2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 45 mm thick. Minimum wall thickness, 3 mm, except beads and trim, 1.25 mm. Door sizes shown are nominal and shall include standard clearances as follows: 2.5 mm at hinge and lock stiles, 3 mm between meeting stiles, 3 mm at top rails, 5 mm between bottom and threshold, and 17 mm between bottom and floor. Bevel single-acting doors 2 or 3 mm at lock, hinge, and meeting stile edges.

2.3.2.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 10 or 13 mm diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 5.48 x 10-5 cubic meter per second of air per square meter of door area when tested in accordance with ASTM E 283.

2.3.5 Anchors and Structural Support

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 635 mm apart. Provide for anchorage and fastening to supporting structure and component to component as shown or required. All anchorage and fastenings shall be non-corrosive and compatible with the aluminum, and adjacent components. Type, size, alloy, quantity and spacing of fasteners and anchorage devices shall be as required for performance. Methods of fastening and fasteners shall be concealed to the greatest extent possible. Structural support, bracing and reinforcement for and related to aluminum framing assemblies shall be designed, furnished, and installed to meet performance criteria.

2.3.5.1 Anchors for Antiterrorism Compliance

Connections for door and mullion frames at exterior locations and locations as indicated shall be by means of threaded machine bolts through U.L.-approved pipe spacers. Bolts shall be fastened to adjacent structural steel members that have been tapped and threaded at appropriate locations. The type, size and number of bolts used shall be as required to meet connection design loading criteria as specified in paragraph 1.2.6 "Antiterrorism Standards".

2.3.6 Provisions for Hardware

Hardware is specified in Section 08710 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws. Provide reinforcement in core of flush doors as required to receive locks, door closers, and other hardware. Locks for all doors shall utilize the same interchangeable core and keying system specified in SECTION: DOOR HARDWARE.

2.3.7 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified. Glazing beads shall be coordinated to provide minimum glazing "bite" of 25 mm. Glazing is specified in Section 08800 GLAZING.

2.3.8 Finishes

Provide exposed aluminum surfaces with factory finish of fluoropolymer

coating as indicated.

2.3.8.1 Fluoropolymer Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.005 to 0.008 mm (0.20 to 0.030 mils) and a color coat of minimum 0.025 mm (1.0 mils), total dry film thickness of 0.030 to 0.033 mm (1.2 to 1.3 mils). Finish shall be free of scratches and other blemishes. Color as indicated on drawings.

PART 3 EXECUTION

3.1 INSPECTION

3.1.1 Pre Installation Inspection

After lines and grades have been established and before beginning installation in any area, contractor and erector shall examine all parts of structure on which the aluminum framing system is to be placed. Should any conditions be found that will prevent proper and timely execution of the work, or endanger its permanency, erection shall not proceed until such conditions are corrected.

3.1.2 Preparation

Verify dimensions of supporting structure by field measurements so that work will be accurately designed, fabricated and fitted to structure. Bench marks for elevations and building line offset marks for alignment shall be established by the Contractor. Should any error be found in their locations, installation or erection will not proceed in affected areas until errors have been corrected.

3.1.3 Embedded Anchors

Provide detailed layout and coordinate placement as required. Coordinate installation and related work with work of other sections and provide items to be placed during installation of the work at proper time to avoid delays in work. Place such items, including inserts and anchors, accurately in relation to final location of components.

3.2 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, transoms and adjoining sidelights. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 2.4 mm thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Seal metal-to-metal joints between framing members as specified in Section 07920 JOINT SEALANTS. Hang doors to produce clearances specified in paragraph entitled "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate

properly.

3.3 TOLERANCES

Components shall conform to the following erection tolerances. Deviations from established vertical, horizontal or designated position shall not exceed 3 mm per 3.5 meters of length of any member. Maximum offset from true alignment between two abutting members shall not exceed 1.5 mm. Maximum joint gap or opening between removable glazing stops, glass pocket fillers, and/or closures, and adjacent members shall not exceed 0.8 mm. Do not erect members that are warped, bowed, deformed or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members damaged in process of erection.

3.4 PROTECTION FROM DISSIMILAR MATERIALS

3.4.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by one or a combination of the following methods:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.

c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.

d. Use a nonabsorptive tape or gasket in permanently dry locations.

3.4.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint, to prevent aluminum discoloration.

3.4.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.4.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.5 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.6 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(2003) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM E 152	(1981ae2) Fire Tests of Door Assemblies
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

FOREST STEWARDSHIP COUNCIL (FSC)

FOREST STEWARDSHIP COUNCIL	(2002) Listing of Certified Wood Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252	(2003) Fire Tests of Door Assemblies
NFPA 80	(1999) Fire Doors and Fire Windows

UNDERWRITERS LABORATORIES (UL)

UL 10B	(1997; Rev thru Oct 2001) Fire Tests of Door Assemblies

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A	(1997) Architectural Wood Flush Doors
WDMA I.S. 4	(2000) Water-Repellent Preservative Non-Pressure Treatment for Millwork
WDMA I.S. 6	(1997) Wood Stile and Rail Doors
WDMA TM-5	(1990) Split Resistance Test Method

WDMA TM-7 (1990) Cycle Slam Test Method

WDMA TM-8 (1990) Hinge Loading Test Method

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Submit drawings or catalog data showing each type of door unit. Drawings and data shall indicate door type and construction, sizes, thickness, methods of assembly,and glazing.

SD-03 Product Data

Doors; G

Accessories

Water-resistant sealer

Sample warranty

Sound transmission class rating; G

Fire resistance rating; G

SD-04 Samples

Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door finish colors; G

Submit a minimum of three color selection samples for selection by the Contracting Officer.

SD-06 Test Reports

Split resistance

Cycle-slam

Hinge loading resistance

Submit split resistance test report for doors tested in accordance with WDMA TM-5, cycle-slam test report for doors tested in accordance with WDMA TM-7, and hinge loading resistance test report for doors tested in accordance with WDMA TM-8.

SD-07 Certificates

For all wood products incorporated as "certified wood" provide evidence of compliance with FOREST STEWARDSHIP COUNCIL (FSC) standards for certified wood. Evidence shall consist of suppliers invoices with certified products indicated on a line item basis.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where wood doors were produced, and percentage of wood doors' raw materials extracted regionally in accordance with LEED-NC RG

1.3 GENERAL REQUIREMENTS

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors. All wood doors shall be installed in metal frames as specified in SECTION 08110 STEEL DOORS AND FRAMES. Hardware, including thresholds, is specified in SECTION 08710 DOOR HARDWARE. Glazing is specified in SECTION 08800 GLASS AND GLAZING.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 100 mm thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Do not store in a building under construction until concrete, masonry work, and plaster are dry. Replace defective or damaged doors with new ones.

1.5 WARRANTY

Warranty shall warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of wood doors with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) All fire rated doors and frames carry required labels.

(5) Reinforcement of doors and frames is coordinated for all specified hardware.

(6) Doors are protected from damage until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 DOORS

Provide doors of the types, sizes, and designs indicated. All wood end grain exposed at edges of doors shall be sealed prior to shipment.

2.1.1 Stile and Rail Doors

Premium or select stile and rail doors conforming to WDMA I.S. 6. When laminated panels are furnished, they shall be not less than three ply. Flat panels shall have a minimum finished panel thickness of 13 mm. Raised panels shall have a minimum finished panel thickness of 20 mm.

2.1.2 Flush Doors

Flush doors shall conform to WDMA I.S. 1-A. Hollow core doors shall have lock blocks and 25 mm minimum thickness hinge stile. Stile edge bands of doors to receive natural finish shall be hardwood, compatible with face veneer. Stile edge bands of doors to be painted shall be mill option specie. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.

2.1.2.1 Interior Flush Doors

Provide particleboard core, Type II flush doors conforming to WDMA I.S. 1-A with faces of premium grade red oak or premium grade white maple as indicated. Hardwood veneers shall be plain sliced bookmatched.

2.1.3 Acoustical Doors

WDMA I.S. 1-A, solid core, constructed to provide Sound Transmission Class rating of 35 when tested in accordance with ASTM E 90.

2.1.4 Composite-Type Fire Doors

Doors specified or indicated to have a fire resistance rating shall conform to the requirements of UL 10B, ASTM E 152, or NFPA 252 for the class of door indicated. Affix a permanent metal label with raised or incised markings indicating testing agency's name and approved hourly fire rating to hinge edge of each door.

2.2 ACCESSORIES

2.2.1 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings except that moldings for doors to receive natural finish shall be of the same specie and color as the face veneers. Moldings for flush doors shall be lip type. Provide glazed openings in fire-rated doors with fire rated frames. Glazing is specified in Section 08800 GLAZING.

2.2.2 Additional Hardware Reinforcement

Provide fire rated doors with hardware reinforcement blocking. Size of lock blocks shall be as required to secure the hardware specified. Top, bottom and intermediate rail blocks shall measure 125 mm minimum by full core width. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements and shall not be mineral material similar to the core.

2.3 FABRICATION

2.3.1 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door.

2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based and identify doors having a Type I glue bond.

2.3.3 Preservative Treatment

Exterior doors shall be water-repellent preservative treated and so marked at the plant in accordance with WDMA I.S. 4.

2.3.4 Adhesives and Bonds

WDMA I.S. 1-A. Use Type I bond for exterior doors and Type II bond for interior doors. Adhesive for doors to receive a natural finish shall be nonstaining.

2.3.5 Prefitting

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

2.3.6 Finishes

2.3.6.1 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows: AWI Qual Stds Section 1500, specification for System No. 4 Conversion varnish alkyd urea or System No. 5 Vinyl catalyzed. The coating shall be AWI Qual Stds premium, medium rubbed sheen, closed grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

2.3.6.2 Color

Provide door finish colors as indicated.

2.3.7 Water-Resistant Sealer

Provide a water-resistant sealer compatible with the specified finishes as approved and as recommended by the door manufacturer.

2.4 SOURCE QUALITY CONTROL

Stiles of "B" and "C" label fire doors utilizing standard mortise leaf hinges shall meet the following performance criteria:

a. Split resistance: Average of ten test samples shall be not less than 225 kilograms load when tested in accordance with WDMA TM-5.

b. Cycle-slam: 200,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of WDMA TM-7.

c. Hinge loading resistance: Average of ten test samples shall be

not less than 315 kilograms load when tested for direct screw withdrawal in accordance with WDMA TM-8 using a No. 12, 30 mm long, steel, fully threaded wood screw. Drill 4 mm pilot hole, use 40 mm opening around screw for bearing surface, and engage screw full, except for last 3 mm. Do not use a steel plate to reinforce screw area.

2.5 CERTIFIED WOOD

A minimum of 50 percent of all lumber and panel products provided under this specification shall be certified wood meeting Forest Stewardship Council standards and certification.

PART 3 EXECUTION

3.1 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp shall not exceed 6 mm when measured in accordance with WDMA I.S. 1-A.

3.1.1 Fire Doors

Install fire doors in accordance with NFPA 80. Do not paint over labels. Operational characteristics shall conform with NFPA 80 and NFPA 101. Follow manufacturer's installation instructions with strict conformance. Do not paint over labels. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lock stile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer. Fire doors shall be installed in fire rated and labeled frames. All frames shall be hollow metal type, see SECTION 08110 STEEL DOORS AND FRAMES.

3.2 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

PRODUCTS	INCH-POUND	METRIC
Closet doors	1 1/8 inches	28.5 mm
	1 3/8 inches	35 mm
Weatherstripping	0.0089 inch	0.23 mm
	0.0063 inch	0.16 mm

-- End of Section --

SECTION 08329

INTEGRATED DOOR ASSEMBLIES

PART 1 GENERAL

1.1 SCOPE OF WORK

Work includes the installation of integrated door assemblies with operating hardware and accessories as required to provide a fire rated (labeled) assembly. Doors and hardware shall conform to requirements of NFPA 80, NFPA 101 (Life Safety Code) and the IBC. Door assemblies are double egress and are located as indicated on drawings. Doors and components shall be an architectural grade system.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors, Frames and Accessories; G

Show elevations, rough opening dimensions, construction details, metal gages, hardware provisions, installation details and fire alarm system connections.

SD-03 Product Data

Doors, Frames and Accessories; G

Submit manufacturer's descriptive data and literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, and door edge construction.

SD-04 Samples

Factory-applied finish; G

Where colors are not indicated, submit manufacturer's standard colors and patterns for selection.

SD-07 Certificates

Doors and Frames; G

Certification that doors are in compliance with code requirements for fire and smoke.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where steel doors and frames were produced, and percentage of steel doors and frames raw materials extracted regionally in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for steel door and frame products.

1.5 QUALIFICATION

Door manufacturer shall specialize in designing and manufacturing the type of doors specified and shall have a minimum of 3 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty. Installation shall be performed by personnel trained in proper installation procedures and approved by the door manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new. Do not use non-vented shelters that will promote corrosion. Doors and assembled frames shall be stored in an upright position. Doors and frames with abraded, scarred or rusty areas shall be cleaned and touched up with the paint used for shop

priming/painting. Replace doors and frames with dents, creases and similar surface distortion with new materials.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties for a minimum period of 10 years shall be provided.

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of installed doors and frames with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Observation of environmental conditions and condition of adjacent construction and finishes.

(2) Protection of all materials during on site storage.

(3) Verification of compliance of materials with specification before, during and after installation.

(4) Protection of labeling on all fire rated doors and frames.

(5) Verification of proper operation of doors, door holders and release on fire alarm activation function.

(6) Protection of door surfaces until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Doors

Assemblies shall be complete with door, hinge and suspension system, locking channel mechanism and smoke seals. Door skin shall be 18 gauge stretcher leveled on 44 mm stressed skin structures, electro-galvanized with bonderized steel faces. Vertical stiles shall be 16 gauge minimum and galvanized. Locking channel shall be 18 gauge. Top rails shall be manufacturer's standard material for rigidity and proper mounting of closer. Door shall be complete with top and bottom caps. Core of door shall be as required for 120 degree C temperature rise. There shall be no seams or spot welding of door faces. All assemblies shall meet ANSI minimum performance standards. Doors shall be labeled for 1.5 hour fire resistance and comply with positive pressure requirements of NFPA and IBC. Doors shall be dual egress type to allow corridor traffic in either direction.

2.1.2 Frames

Frames shall conform to SDI Standards 100 and 111A for steel frames, all welded unit with ASTM A1008 cold rolled steel, 16 gauge, with same fire resistance as doors. Provide labeled frame anchorage devices to securely anchor frames to wall construction. Frames shall otherwise conform with the requirements of SECTION: STEEL DOORS AND FRAMES.

2.1.3 ANSI/BHMA Performance Standards

Fire Rating: 2 hours
Steel Doors: Level A (1,000,000 cycles)
Hinges: Grade 2
Exit Devices: Grade 1

2.1.4 Hardware

Hardware attached to the door shall be factory installed. Each door shall be complete with panic exit devices, operating grip pulls, closers, head strike and magnetic holders. Exit devices shall be touch bar type and shall be "full flush" (3 mm maximum projection). Do not provide locks, doors shall always be free to open. Hinges shall be continuous, semi-concealed type. Coordinate electromagnetic release devices(ERD)to provide release upon activation of the fire alarm system. Provide kick plate on push side of doors.

2.1.5 Finishes

Doors and frames shall be factory prime painted for field finish to match adjacent wall color. Hinges and locking channels and other miscellaneous exposed hardware shall be manufacturer's standard color finish or satin anodized finish.

2.1.6 Operation

Doors shall be held in open position in side wall pockets by electromagnetic release devices. When activation of the fire alarm system occurs from an actual alarm condition or an alarm test, the ERD shall be automatically de-energized and doors shall swing to closed position and form a complete barrier across the corridor. Closure function shall be completed without any need for manual manipulation of the doors or hardware. Upon reset of the fire alarm system, the hold opens shall be re-energized. Doors manually moved to the full open position shall magnetically latch to the hold open and remain in the open position. Doors shall be configured as a double egress style opening.

2.1.7 Reference Product

Total Door
40 W. Howard
Pontiac, MI 48342-1280
P 800-852-6660 F 248-335-6868

PART 3 EXECUTION

3.1 PREPARATION

Verify all field conditions and dimensions prior to fabrication of doors. Correct or coordinate all field conditions that are not consistent with shop drawings. Door assembly details shall be provided to stud wall installers for review. Do not enclose wall construction prior to review by door installers.

Examine areas of building to receive door assemblies prior to the start of installation. Verify that all construction is complete and prepared for door installation, including additional wall framing required for anchorage and location of electrical and alarm system conductors. Do not begin installation if conditions do not permit proper installation.

3.2 INSTALLATION

Doors shall be installed in accordance with the drawings and this specification by door manufacturer trained and approved installers. Coordinate installation with the fire alarm system interface wiring requirements. Installation shall conform to ADAAG requirements for universal accessibility.

3.2.1 Frame Tolerance

Inspect frames for plumb, square and compliance to DHI standards. Maximum out of square allowed at frame head is 1.5 mm. Maximum out of plumb for each frame side of opening is 1.5 mm. Maximum out of alignment dimension is 1.5 mm. Maximum twist dimension is 1.5 mm. Do not install doors unless frames meet these criteria.

3.2.2 Door Tolerance

Hang doors and adjust for free swinging operation without binding, sticking, sagging or clearance defects. Maintain manufacturer's printed installation tolerances.

3.3 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.4 ADJUSTMENTS AND CLEANING

3.4.1 Hardware Adjustments

Final operating adjustments shall be made after installation is complete. All hardware shall be tested for proper operation. Verify release and reset of electromagnetic release devices.

3.4.2 Cleaning

Door surfaces and hardware shall be cleaned in accordance with door assembly manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring surfaces. Protect door surfaces until occupancy.

-- End of Section --

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(1999) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
AAMA 1503	(1998) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 CERTIFICATION

Each prime window unit shall bear the AAMA Label warranting that the product complies with AAMA 101. Certified test reports attesting that the prime window units meet the requirements of AAMA 101, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, screen details including method of attachment,, and window schedules showing locations of each window type.

SD-03 Product Data

Windows; G

Hardware; G

Fasteners; G

Screens; G

Weatherstripping; G

Accessories; G

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraphs 2.1 WINDOWS and 2.2 FABRICATION.

SD-04 Samples

Finish Sample

Window Sample

SD-05 Design Data

Structural calculations or test reports; G

Submit calculations or test reports demonstrating that frames, mullions, window hardware and frame anchors meet design load requirements specified. Calculations shall be signed by a licensed engineer. Test reports shall be provided by a nationally recognized testing agency.

SD-06 Test Reports

Minimum condensation resistance factor

Resistance to static load requirements

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOWS.

SD-07 Certificates

Aluminum Windows; G

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where aluminum windows are produced, and percentage of aluminum windows' raw materials extracted regionally in accordance with LEED-NC RG

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Drawings shall indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, method of attaching screens, material and method of attaching subframes, casings, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish

color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping is required, fit sample windows with such items that are to be used. After approval, install each sample in work, clearly identified, and record its location.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with static load and deflection requirements. Calculations shall be provided by a Professional Engineer.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA 101 including test size, and minimum condensation resistance factor (CRF).

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 3 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.7 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.8 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided. A ten year, zero condensation warranty shall be provided for all insulating glass units.

1.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of exterior brick veneer wall construction with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verification of proper operation of all venting units.

(5) Protection of all window surfaces until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 WINDOWS

Prime windows shall comply with AAMA 101 and the requirements specified herein. In addition to compliance with AAMA 101, window framing members for each individual lite of glass shall not deflect to the extent that deflection perpendicular to the glass lite exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Structural calculations for deflection shall be provided to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 50 when tested in accordance with AAMA 1503.

Exterior frames, mullions, and window hardware shall be designed to resist equivalent static design loads of 7 kilopascals applied to the surface of the glazing. Frame and mullion deformations shall not exceed 1/60 of the unsupported member lengths. The Contractor must demonstrate by calculations or tests that the window complies with the loading requirement.

Equivalent static design loads for connections of window to the surrounding walls or hardware and associated connections, and glazing stop connections shall be 75 kilopascals for glazing panels with a vision area less than or equal to 1.0 square meter and 30 kilopascals for glazing panels with a vision area greater than 1.0 square meter but less than or equal to 3.0

square meters. Alternatively, use frames that provide an equivalent level of performance.

2.1.1 Casement Windows (C)

Type C-HC or AW. Ventilators shall be rotary crank operated. Provide ventilators over 1650 millimeters high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible.

2.1.2 Fixed Windows (F)

Type F-HC or AW.

2.1.3 Glass and Glazing

Materials are specified in Section 08800 GLAZING. Aluminum windows shall be designed for inside or outside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08800 GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101 and the additional loading criteria specified. Glazing material shall be compatible with aluminum, and shall not require painting.

2.1.4 Calking and Sealing

Are specified in Section 07920 JOINT SEALANTS.

2.1.5 Weatherstripping

AAMA 101.

2.2 FABRICATION

Fabrication of window units shall comply with AAMA 101.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown or specified. Exterior glazing shall have a minimum frame bite of 9.5 mm for structurally glazed window systems and 25 mm for window systems that are not structurally glazed. Design sash for inside or outside glazing and for securing glass with metal beads, glazing clips, glazing channels, or glazing compound.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA 101. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do not use neoprene or polyvinylchloride

weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Fastening devices for windows, trim, and accessories shall be window manufacturer's standard design made from aluminum or non-magnetic stainless steel, in compliance with AAMA 101. Self-tapping sheet-metal screws are not acceptable for material more than 2 mm thick.

2.2.4 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101. Window anchors shall be designed to transfer the specified loads to the surrounding wall framing.

2.2.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Provide drips and weep holes as required to return water to the outside.

2.2.6 Combination Windows

Windows used in combination shall be the same class and grade and shall be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.7 Mullions and Transom Bars

Mullions, and transom bars shall be designed to resist equivalent static design loads of 7 kilopascals applied to the surface of the glazing. Deformations shall not exceed 1/60 of the unsupported member lengths. The Contractor must demonstrate by calculations or tests that the mullions comply with the loading requirement. Provide mullions with a structural thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance. Provide special covers over structural support (required by design loads) at mullions.

2.2.8 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.8.1 Hardware

AAMA 101. The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for

which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.8.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 150 mm from each end and at midpoint.

2.2.9 Finishes

Exposed aluminum surfaces shall be factory finished with a fluoropolymer coating as indicated. Colors shall be as indicated. All windows shall have the same finish.

2.2.9.1 Fluoropolymer Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.005 to 0.008 mm (0.20 to 0.030 mils) and a color coat of minimum 0.025 mm (1.0 mils), total dry film thickness of 0.030 to 0.033 mm (1.2 to 1.3 mils). Finish shall be free of scratches and other blemishes. Color as indicated on drawings.

2.2.10 Screens

AAMA 101. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware. Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of extruded tubular-shaped aluminum frames conforming to SMA ANSI/SMA 1004 and vinyl coated glass screening conforming to ASTM D 3656.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in

place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to AAMA 101. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 11 mm.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Adjust single hung windows to operate with maximum applied force of 25 pounds in either direction, not including breakaway friction force.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weatherstripping, and to prevent interference with the operation of hardware. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

3.3 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

PRODUCTS	INCH-POUND	METRIC
Metal Casing	0.0625 inch	1.59 mm
Aluminum Tube	0.0625 inch	1.59 mm
(Diameter)	1 inch	25 mm

-- End of Section --

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SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 283	(1991; R 1999) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F 883	(1997) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.2	(1996) Bored and Preassembled Locks and Latches
BHMA A156.3	(2001) Exit Devices
BHMA A156.4	(2000) Door Controls - Closers
BHMA A156.5	(2001) Auxiliary Locks & Associated Products
BHMA A156.6	(2001) Architectural Door Trim
BHMA A156.7	(2003) Template Hinge Dimensions
BHMA A156.8	(2000) Door Controls - Overhead Holders and Holders
BHMA A156.13	(2002) Mortise Locks & Latches, Series 1000
BHMA A156.15	(2001) Closer Holder Release Devices
BHMA A156.16	(2002) Auxiliary Hardware
BHMA A156.17	(1999) Self Closing Hinges & Pivots
BHMA A156.18	(2000) Materials and Finishes
BHMA A156.21	(2001) Thresholds

BHMA A156.22	(2003) Door Gasketing and Edge Seal Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 80	(1999) Fire Doors and Fire Windows

STEEL DOOR INSTITUTE (SDI)

SDI 100	(1998) Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2003) Building Materials Directory

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1190	Uniform Federal Accessibility Standards (UFAS)
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hardware schedule; G

Keying system

Electronic entry diagrams; G

Submit schematic wiring and component diagrams for each entrance utilizing electronic devices such as magnetic switches, electric locks or interface with intrusion detection system.

SD-03 Product Data

Hardware items; G

SD-07 Certificates; G

Hardware Compliance with NFPA and BHMA Standards

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule; G

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule using the following column format:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designation

1.4 KEY BITTING CHART REQUIREMENTS

Submit the original key bitting charts in a sealed envelope to the Contracting Officer prior to completion of the work. Envelope shall include the name of the project and be addressed to: "Fort Lewis Public Works Lock Shop Manager". Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.5.2 Accessibility

Hardware shall meet or exceed the requirements of 36 CFR 1191 Americans with Disabilities Act Accessibility Guidelines (ADAAG) and 36 CFR 1190 Uniform Federal Accessibility Standards (UFAS).

1.5.3 Aluminum Doors and Storefronts

Hardware mounted on aluminum doors and storefront systems shall be coordinated by the door manufacturer and factory installed as consistent with industry standards. Hardware for aluminum doors shall be indicated in this section. Provide hardware templates and hardware as appropriate, except field-applied hardware, to the aluminum door manufacturer for use in fabricating the doors and frames.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

1.7 CONTROL OF LOCK CORES AND KEYING

The contractor shall provide all hardware and construction (temporary) cores required to secure buildings, utility access and related work throughout the construction period. Construction cores shall have a bright color on their exposed face for ease of identification. During construction the contractor shall meet with representatives of the contracting officer, Public Works Lock Shop and the user to develop a keying schedule. This schedule shall be submitted for approval in accordance with Article: Submittals. The contractor shall provide final lock cores, complete, pinned and combinated, with cut keys as specified. All final keying and combinating shall be performed by a licensed, bonded locksmith approved by the contracting officer. Upon acceptance of the facility for occupancy, the contractor shall replace construction cores with final cores in the presence of the government inspector and a Public Works locksmith, test each lock for proper operation and deliver any permanent or control keys to the inspector. Prior to core change out the contractor shall provide the government, by security shipment, with permanent keys tagged with identifying labels in the quantities indicated.

1.7.1 Authorized Locksmiths

The following locksmiths are currently (June 2004) approved by the Fort Lewis Public Works Lock shop to combinate cores for locksets used in this project. Verify that authorization remains current prior to beginning lock/core related work on this project.

BEYOND SECURITY
POC: Julie Santie
11420 Hwy 302 N.W.
Gig Harbor, WA 98329
(253) 291-9938

HARBOR ENTERPRISES
POC: Mike Quanrud
3523 140th St. Ct. N.W.
Gig Harbor, WA 98332
(253) 851-8466

SECURITY UNLIMITED
POC: Mike Pennella
8205 E. Martin Way #188
Olympia, WA 98516
(360) 412-9005

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of installed door hardware with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Control of keys and permanent lock cores as specified.

(2) Protection of all materials during on site storage.

(3) Verification that all hardware coordination related to accessibility and fire rated construction requirements is performed.

(4) Verification of compliance of materials with specification before, during and after installation.

(5) Coordination of keying schedule meeting with Public Works Locksmith.

(6) Verification of proper hardware function on all openings.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Such hardware shall bear the label

of Underwriters Laboratories, Inc., and be listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to the contracting officer.

2.3 HARDWARE ITEMS

Hinges, pivots, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

Hinges (butts) shall be full mortise type, conform to ANSI/BHMA A156.1, size 114 mm by 114 mm for door widths up to 915 mm, except where specified otherwise. Hinges for doors between 915 mm and 1220 mm shall be full mortise type, conform to ANSI/BHMA A156.1, size 127 mm by 127 mm "Heavy Weight". Design of hinge shall not restrict full opening arc of door swing. All doors equipped with closers, and as otherwise specified, shall use a ball bearing hinge. Hinges on exterior doors shall be stainless steel or aluminum as indicated. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be non-removable (NRP) when door is closed. All exterior aluminum doors, interior aluminum doors at vestibules and doors on stair enclosures shall be equipped with a continuous geared hinge.

2.3.1.1 Continuous Geared Hinges

Provide continuous geared hinges as indicated on the door hardware sets listed at the end of this specification section. Hinges shall be heavy duty geared aluminum with engineered polymer PTFE bearing. Contact between the aluminum hinges and steel doors they attach to shall be broken by a continuously applied material such as an elastomeric pad or other material specifically formulated to break contact between dissimilar metals.

2.3.2 Pivots

BHMA A156.4.

2.3.3 Spring Hinges

BHMA A156.17.

2.3.4 Locks and Latches

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Unless otherwise specified, all locks and latches shall be provided complete with manufacturer's standard strike. Strikes for pairs of wood doors shall be furnished with wrought boxes. Strikes for metal frames shall have manufacturer's standard boxes. Lock and latch trim (levers, handles, roses and escutcheons) shall be of simple design in accordance with manufacturer's standard practice. Levers shall have a minimum length of 110 mm.

2.3.4.1 Mortise Locks and Latches

BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Mortise locksets with levers shall be provided with escutcheon trims not less than 178 mm high by 57 mm wide. Do not provide escutcheon where entrance is by fixed pull. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Escutcheons shall be equipped with bushings not less than 6 mm long. All mortise locksets shall have armored fronts. All trims for mortise locksets shall have screwless shanks and no exposed screws.

2.3.4.2 Bored Locks and Latches

BHMA A156.2, Series 4000, Grade 1.

2.3.4.3 Auxiliary Locks

BHMA A156.5, Grade 1. Bored and mortise deadlocks and latchsets, narrow stile locks, rim locks, electric strikes, monitor strikes, and exit alarms and/or locks shall conform to ANSI/BHMA A156.5, Grade 1. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

2.3.4.4 Programmable Pushbutton Locks

Electronic (stand alone battery power) cylindrical lockset with clutch mechanism shall comply with ANSI/BHMA 156.2, Grade 1 (extra heavy duty). Latchbolt shall be 18 mm throw with 70 mm backset. Latchbolt shall engage manufacturer's standard strike plate and matching strike box. Lock shall be powered by internal batteries providing 4 years of operation. All lock operation code entry and programming shall be performed using a 12 button keypad. Front housing shall also provide red and green indicator lights and an acoustic device to signal lock status to the user. Lever handles shall comply with Americans with Disabilities Act (ADA). Design of lever shall be of single piece construction without any return at the end. Outside lever shall be connected to a heavy duty clutch mechanism that will permit turning the lever without retracting the latch in the locked position. Inside and outside levers shall operate independent of each other. Inside lever provides free egress at all times. Unlocking angle of rotation should not exceed 45 degrees. Outside lever shall accommodate an A-2 SFIC. Core shall allow mechanical override key operation of the lockset. Programmable pushbutton feature shall provide ability to easily change code combinations. Multiple entry codes (4 minimum) and authorization levels shall be provided. User entry code shall be adjustable from 3 to 6 digits. Memory of lock shall be non-volatile and shall retain codes for at least 1 year without battery power and while batteries are being changed. Lock shall include a tamper resistance shut down feature to limit guessing of access codes. Shut down will be maintained for up to 15 minutes.

Example product: Unican 4000 Series, by ILCO Unican Corp.

2.3.4.5 Electromagnetic Locks

ANSI/BHMA 156.23, Grade 1. The electromagnetic lock shall operate on 24VDC

and shall have a minimum holding force of 7,340 newtons (1,650 lbs.). The armature housing shall be designed to eliminate operating noise and sagging. Opening shall be initiated by a card reader located on the wall outside the room the door serves or a wall mounted "request to exit" button inside the room. The lock shall be equipped with the following features:

Adjustable time delay from 1 to 30 seconds.

Anti-tamper switch that provides an indication that the cover of the magnet is securely fastened to the lock.

Door status monitor that indicates that the door is opened or closed.

Magnetic bond monitor that indicates that the proper bond exists between the magnet and the armature and that the door is locked.

Example product: Locknetics Magforce 390+ High Security Lock

2.3.5 Exit Devices

BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Touch bars shall be provided in lieu of conventional crossbars and arms. Exit devices shall be rim, surface-mounted vertical rod, or mortise type. Rim and surface-mounted vertical rod exit devices shall have dead-locking latchbolts to prevent tampering. Provide adjustable strikes for rim type. Provide open back strikes for pairs of doors with mortise. Touch bars shall be provided in lieu of conventional crossbars and arms. Exit devices at full glazed doors shall have a continuous cover plate on the back side of the horizontal member to provide a clean, finished appearance when viewed through glazing, finish of cover plate shall match the exit device. Exit devices shall have a mechanical dogging feature. Vertical rod exit devices shall be provided with guards to the bottom rod and latch to prevent damage and misalignment from kicking or carts. Guards shall be a standard option available from the exit device manufacturer.

2.3.5.1 Exit Device Trim

Style and features for exit device trims shall be as indicated on the door hardware sets listed at the end of this specification section. Escutcheon plates shall be a minimum 19 mm thick forged brass with finish as indicated. All levers shall be of a breakaway vandal resistant design such that when more than 156 newtons (35 pounds) of force is applied, the lever breaks away and travels to a 90-degree down position. To prevent further damage to the internal trim parts or to the exit device, the trim shall also be provided with a replaceable shear pin that breaks at a minimum 289 newtons (65 pounds) of force.

2.3.6 Exit Locks With Alarm

BHMA A156.5, Grade 1, Type E0431 (with full-width horizontal actuating bar) for single doors; Type E0431 (with actuating bar) or E0471 (with actuating

bar and top and bottom bolts, both leaves active) for pairs of doors, unless otherwise specified.

2.3.7 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores shall have six pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets shall have interchangeable cores which are compatible with A-2 SFIC (A-2 system specifications are available at http://www.lab-lockpins.com/pinsicore.htm)and are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.
Cylinders shall be fully compatible with products of the Best Lock Corporation, Arrow Lock Corporation, or Falcon Lock. Submit a core code sheet with the cores. The cores shall be master keyed in one system for this project. Provide construction interchangeable cores.

2.3.8 Keying System

Provide a great grand master keying system as coordinated in keying schedule meeting with government. Provide a construction master keying system consistent with construction interchangeable cores. Provide key cabinet as specified.

2.3.9 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.9.1 Knobs and Roses

In addition to meeting test requirements of BHMA A156.2 and BHMA A156.13, knobs, roses, and escutcheons shall be 1.25 mm thick if unreinforced. If reinforced, outer shell shall be 0.89 mm thick and combined thickness shall be 1.78 mm, except knob shanks shall be 1.52 mm thick. Knobs shall be used only where indicated. Lever handles are standard. Knob design shall be as indicated on the door hardware sets listed at the end of this specification section.

2.3.9.2 Lever Handles

Provide lever handles as standard. Lever handles for exit devices shall meet the test requirements of BHMA A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in BHMA A156.13 is applied to the lever handle. Lever design shall be as indicated on the door hardware sets listed at the end of this specification section.

2.3.9.3 Texture

Provide knurled or abrasive coated knobs or lever handles where specified in paragraph entitled "Hardware Schedule".

2.3.10 Keys

Furnish four (4) keys for each lock core KD (keyed different), and four keys for each set KA (keyed alike) to the Contracting Officer for delivery to the Fort Lewis Public Works Lock Shop for control and issuing. In addition to the keys listed above, furnish four additional key blanks per core KA. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Key bows must be stamped with key code line ID (example: LA1223, MPA1223, etc.). All Fort Lewis codes are 1 to 4 letters and 1 to 4 numbers. Public Works Lock Shop will provide ID information and Master control number to be used in combinating core. Do not place room number on keys.

2.3.11 Door Bolts

BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: BHMA A156.3, Type 25.

2.3.12 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C and PT-4D. All closers (except those mounted on fire rated doors) shall have holder arms and be provided with built in hold open and dead stop functions. (Closer/Holders specified for stairway and corridor doors are specified separately herein.) Closers shall have speed and opeing force adjusted to meet ADA requirements. Closers on doors swinging against a wall at 90 degrees shall be provided with PT-4E adjustable hydraulic backcheck. Provide closers with brackets, arms, mounting devices, fasteners, full size covers (except at storefront mounting), pivots, cement cases, and other features necessary for the particular application and functional requirements. Provide multi-size closers PT-4H Sizes 1 through 6, and list sizes in the Hardware Schedule. Closers for outswinging exterior doors shall be parallel arm type or shall be top jamb mounted as indicated in hardware sets. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position. Provide manufacturer's 10 year warranty.

2.3.12.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.13 Overhead Holders

BHMA A156.8.

2.3.14 Release Devices

2.3.14.1 Closer/Holder

BHMA A156.15. The closer/holder shall conform to the requirements of NFPA

101, Life Safety Code (2003 Edition) and it shall be a single-point hold open device that operates on 24 VAC power as supplied from or controlled by the building fire alarm panel. Hold-open points shall be adjustable from 90 degrees of open to 120 degrees of open in 3 degree increments. Hold-open force shall be adjustable. Once set in the hold-open position, the device shall keep the door open until manually released by pushing on the door or until current interruption from the fire alarm panel releases the holding mechanism and the door closes. Closing force shall be adjustable. The device shall be mounted to hinge side of doors with the single lever track concealed in the top door frame. The device shall be wired at the door frame. Finish for the closer/holder shall be as indicated on the door hardware sets listed at the end of this specification section. The closer/holder shall have a minimum 2-year factory-supplied warranty.

Example product: LCN 4040SEL Hinge Side Mount

2.3.14.2 Electromagnetic Release Device

BHMA A156.15. The electromagnetic release device (ERD)shall conform to the requirements of NFPA 101, Life Safety Code (2003 Edition) and it shall be a single-point hold open device that operates on 24 VAC power as supplied from or controlled by the building fire alarm panel. Device shall provide fail safe operation with a minimum of 14 kg holding power. Once doors are set in the hold-open position, the device shall keep the door open until manually released by push button (located on ERD or adjacent wall mount), or until current interruption from the fire alarm panel releases the holding mechanism and the door closes. The ERD base shall be mounted to wall with compatible contact plate on door. Finish for ERD shall be as indicated on the door hardware sets listed at the end of this specification section. The ERD shall have a minimum 2-year factory-supplied warranty.

Example product: Rixson Models 996 thru 999

2.3.15 Door Protection Plates

BHMA A156.6.

2.3.15.1 Sizes of Armor, Mop and Kick Plates

Width for single doors shall be 50 mm less than door width; width for pairs of doors shall be 25 mm less than door width. Height of kick plates shall be 254 mm for flush doors and 25 mm less than height of bottom rail for panel doors. Height of armor plates shall be not less than 900 mm for flush doors, except that armor plates on fire doors shall be 400 mm high. Height of mop plates shall be 100 mm.

2.3.16 Edge Guards

BHMA A156.6, stainless steel, of same height as armor plates. Apply to hinge stile and lock stile.

2.3.17 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each door of a pair.

2.3.18 Padlocks

ASTM F 883. Incorporate cores and keying compatible with that specified for other locks.

2.3.19 Padlock Eyes

Padlock eyes shall be steel, 2 mm nominal thickness, with plated finish. Eyes shall be sized for attachment to door/hatch and frame with minimum 4 sheet metal screws each. Locate eyes 300 mm above latchset with one eye attached to door edge and second eye attached to immediately opposing frame surface such that eyes align side by side when door is closed and all screws are concealed. Maximum projection from door face to tip of eyes shall be 30 mm. Eye hole diameter and projection from door shall permit the use of standard combination or key type padlocks. Coordinate frame and door fabrication to provide for recess mounting of eye plates and reinforcement. Coordinate required door gap to accommodate eye thickness without restricting door swing.

2.3.20 Thresholds

BHMA A156.21. Thresholds shall be as indicated on the door hardware sets listed at the end of this specification section. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance for door swing and effective seal with specified weather stripping. Thresholds for use with floor closers shall conform to BHMA A156.4. Where required, thresholds shall be modified to receive projecting bolts of exit devices.

2.3.21 Weather Stripping Gasketing

BHMA A156.22. Weather stripping shall be as indicated on the door hardware sets listed at the end of this specification section. A set shall include head and jamb seals, sweep strips, and, for pairs of doors, astragals or meeting stiles. Air leakage of weather stripped doors shall not exceed 5.48 x 10-5 cms per minute of air per square meter of door area when tested in accordance with ASTM E 283. Weather stripping shall be one of the following:

2.3.21.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 1.25 mm wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall be anodized as indicated.

2.3.21.2 Interlocking Type

Zinc or bronze not less than 0.45 mm thick.

2.3.21.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.20 mm thick.

2.3.22 Soundproofing Gasketing

BHMA A156.22. A set shall include adjustable doorstops at head and jambs and an automatic door bottom, both of extruded aluminum, anodized, surface applied, with vinyl fin seals between plunger and housing. Doorstops shall have solid neoprene tube, silicone rubber, or closed-cell sponge gasket. Door bottoms shall have adjustable operating rod and silicone rubber or closed-cell sponge neoprene gasket. Doorstops shall be mitered at corners. Provide the type and function designation where specified in paragraph entitled "Hardware Sets".

Example products: Zero "Sound Stop 1" (No. 770 and No. 361); Pemko No. 350ASN and No. 430AS; National Guard No. 1038N and No. 420; or equal.

2.3.23 Rain Drips

Extruded aluminum, not less than 2.0 mm thick, anodized, color as indicated. Set drips in sealant conforming to Section 07920 JOINT SEALANTS and fasten with stainless steel screws.

2.3.23.1 Door Rain Drips

Approximately 38 mm high by 16 mm projection. Align bottom with bottom edge of door.

2.3.23.2 Overhead Rain Drips

Approximately 38 mm high by 64 mm projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.3.24 Astragals

Astragals on exterior doors shall provide weather seal consistent with weatherstripping hardware. Astragals on fire rated doors shall be tested and listed for use as fire door hardware.

2.3.25 Surface Bolts

BHMA A156.16. L04151, or as otherwise scheduled, finish as indicated. Provide at head and sill of inactive door leaf where indicated. Furnish complete with dust proof strikes, L04021.

2.3.26 Lever Extension Bolts

BHMA A156.16. L04251, or as otherwise scheduled, finish as indicated. Listed and labeled for fire doors. Provide at head and sill of inactive door leaf as indicated on the door hardware sets listed at the end of this specification section. Lever extension bolts shall not be installed on any exit doors. Furnish complete with dust proof strikes, L04021.

2.3.27 Push and Pull Bars

Push and pull bars shall be stainless steel, minimum 25 mm diameter, with satin stainless finish. Pulls shall be through bolted. Top bolt of pull shall continue through door and anchor pushbar.

Example products: Hiawatha 609 (pull) and 1081LBP (push).

2.3.28 Coordinator

Coordinators for door pairs with astragals shall be the steel tube type with linked trigger and hold open cams, UL listed, designed for frame head stop mounting. Coordinator shall not be visible from exterior side of opening when doors are closed.

Example product: Ives COR52

2.3.29 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

BHMA A156.18. Hardware shall have the following BHMA finish types unless scheduled otherwise. Hardware, regardless of base material, shall be coordinated to provide a consistent finish at each opening. Standard finishes shall be:

BHMA 600	primed for painting (steel)
BHMA 626	satin chromium plated (brass or bronze)
BHMA 630	satin stainless steel (stainless steel 300 series)
BHMA 652	satin chromium plated (steel)
BHMA 673	aluminum clear coated (aluminum)
BHMA 689	aluminum painted (aluminum)
BHMA 713	satin chromium anodized (aluminum)
BHMA 718	satin aluminum uncoated (aluminum)

Exceptions:

Surface door closers may have covers finished with aluminum paint to match finish at opening. Exposed parts of concealed closers shall have finish to match lock and door trim.

Steel hinges, where noted in schedule, shall have BHMA 600 finish (primed for painting)

Hardware for aluminum doors shall be finished to match the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

BHMA A156.5, provide one key cabinet.
Cabinet type (E8341) as required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation. Door control devices for exterior doors such as closers and holders, shall normally attach to doors with through bolts such as sex bolts and nuts. Through bolts shall be finished to match the door. Through bolting of aluminum doors is not acceptable.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 225 mm o.c. after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door 25 mm o.c. and to heads and jambs at 100 mm o.c.

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 38 mm o.c.

3.1.2 Soundproofing Installation

Install as specified for stop-applied weather stripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.1.4 Door-Closing Devices

Door closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door. Closer locations shall be coordinated with the door manufacturer to ensure proper reinforcement of the door.

3.1.5 Armor, Kick and Mop Plates

Kick, mop and armor plates shall be provided as indicated on the door hardware sets listed at the end of this specification section. Mop plates shall be installed on the pull side of single acting doors with bottom flush with door bottom.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers and hinges shall have a visible label or stamp indicating that the hardware items have been approved by "an approved testing agency for installation on fire-rated doors". Hardware for smoke-control door assemblies shall be installed in accordance with NFPA 105.

3.3 HARDWARE LOCATIONS

SDI 100, unless indicated or specified otherwise.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed by contracting officer. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit proposed date(s) of testing and core installation 15 days before scheduled, so that testing can be witnessed by the Contracting Officer and installation representative. Schedule shall be approved/confirmed by the government. Adjust hinges, locks, latches, bolts, holders, closers, and other hardware items to operate properly and provide full opening functionality. Replace construction cores with permanent cores. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work. Any damaged hardware, including cosmetic damage, shall be replaced with new hardware.

3.6 HARDWARE SETS

Hardware for aluminum doors shall be provided under this section. Deliver Hardware templates, product data and hardware, except field-applied hardware, to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

Where possible, all door hardware components are listed with ANSI/BHMA standard numbering and nomenclature for door hardware. Indication of specific manufacturer's product(s)is made for purposes of clarification of intent only. Use of other manufacturer's products conforming to the specified characteristics of the product indicated is acceptable.

3.7 CHAPEL HARDWARE SETS (AHHW)

HW-1 (Exterior/Aluminum Door Pairs)
Door No.: **3A, 3B, 3C; 9A, 9B**

Hinges: (both leafs)	(2)	Continuous aluminum geared hinge (Stanley No. 662HD or equal) (673)
Exit Device: (both leafs)	(2)	Grade 1, type 6, function 02 x push pad type (630)
Exit Device Trim: (both leafs)	-	No exit device trim - use pulls
Pulls: (both leafs)	(2)	J402-250mm c to c (630)
Closer: (both leafs)	(2)	C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (both leafs)	(2)	L01371 (626 or 630)
Threshold:		Match Pemko 272A
Weatherstripping:		Match Pemko S88BL
Door Bottom: (both leafs)	(2)	Match Pemko 222AV

HW-2 (Exterior/Aluminum Door Pairs)
Door No.: **6**

Hinges: (both leafs)	(2)	Continuous aluminum geared hinge (Stanley No. 662HD or equal) (673)
Exit Device: (left leaf)	(1)	Grade 1, type 6, function 02 x push pad type (630)
Exit Device: (right leaf)	(1)	Grade 1, type 3, function 08 x push pad type (630)
Exit Device Trim: (both leafs)	(2)	Match Von Duprin Model No. 996L w/lever style #07
Closer: (both leafs)	(2)	C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (both leafs)	(2)	L01371 (626 or 630)
Threshold:		Match Pemko 272A
Weatherstripping:		Match Pemko S88BL
Door Bottom: (both leafs)	(2)	Match Pemko 222AV

HW-3 (Interior Vestibule/Aluminum Doors
Door No.: **2A, 2B, 2C; 5; 8A, 8B**

Hinges: (2) Continuous aluminum geared hinge
(both leafs) (Stanley No. 662HD or equal) (673)
Push Bars: (2) J501 (630) push shares 1 thru bolt w/ pull
(both leafs)
Pulls: (2) J402-250mm (630)
(both leafs)
Closer: (2) C02061 with options PT-4C and PT-4D (689)
(both leafs)
Threshold: Match Pemko 272A
Weatherstripping: Match Pemko S88BL
Door Bottom: (2) Match Pemko 222AV
(both leafs)

HW-4 (Exterior/Aluminum Doors)
Door No.: **125C and 133C**
Hinges: (1) Continuous aluminum geared hinge
(Stanley No. 662HD or equal) (673)
Exit Device: (1) Grade 1, type 3, function 08 x push pad (630)
Exit Device Trim: (1) Match Von Duprin Model No. 996L w/lever style #07
Closer: (1) C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (1) L01371 (626 or 630)
Threshold: Match Pemko 272A
Weatherstripping: Match Pemko S88BL
Door Bottom: (1) Match Pemko 222AV

HW-5 (Exterior/Insulated Metal Door)
Door No.: **10C**
Hinges: (1) Continuous aluminum geared hinge
(Stanley No. 662HD or equal) (673)
Exit Device: (1) Grade 1, type 3, function 09 x push pad type(630)
Exit Device Trim: (1) Match Von Duprin Model No. 996L w/lever style #07
Closer: (1) C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (1) L01371 (626 or 630)
Threshold: Match Pemko 272A
Weatherstripping: Match Pemko S88BL
Door Bottom: (2) Match Pemko 222AV

HW-6 (Exterior/Insulated Metal Door)
Door No.: **1C**
Hinges: (1) Continuous aluminum geared hinge
(Stanley No. 662HD or equal) (673)
Exit Device: (1) Grade 1, type 3, function 09 x push pad type(630)
Exit Device Trim: (1) Match Von Duprin Model No. 996L w/lever style #07
Lockset: (1) Programmable push button lock.
Closer: (1) C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (1) L01371 (626 or 630)
Threshold: Match Pemko 272A
Weatherstripping: Match Pemko S88BL
Door Bottom: (1) Match Pemko 222AV

HW-7 (Exterior/Insulated Metal Door Pair)
Door No.: **129 (active leaf on right)**
Hinges: (2) Continuous aluminum geared hinge
(both leafs) (Stanley No. 662HD or equal) (673)

Lockset: (1) F04 with lever handle
(active leaf) (Best No. 16 or equal) (630)
Half Dummy Trim: (1) Match lever and rose (interior only)
(inactive leaf)
Closer: (2) C02061 with options PT-4C and PT-4D (689)
(both leafs)
Stop/Holder: (2) L01371 (626 or 630)
Surface Bolt: (2) L04161 at head and sill (626 or 630)
(inactive leaf)
Astragal: (1) Match Pemko 355PWS - paint door color.
Threshold: Match Pemko 157A
Weatherstripping: Match Pemko S88BL
Door Bottom: (2) Match Pemko 216AV

HW-8 (Exterior/Insulated Metal Door)
Door No.: **127**
Hinges: (1) Continuous aluminum geared hinge
(Stanley No. 662HD or equal) (673)
Lockset: (1) F04 with lever handle
(Best No. 16 or equal) (630)
Closer: (1) C02061 with options PT-4C and PT-4D (689)
Stop/Holder: (1) L01371 (626 or 630)
Threshold: Match Pemko 157A
Weatherstripping: Match Pemko S88BL
Door Bottom: (1) Match Pemko 216AV

HW-9 (Wood Door Pairs)
Door No.: **100B, 100C, 100D, 100G, 100H, 100I**
Hinges: (3 pr.) 114mm x 114mm A5111 (630)
Exit Device: (2) Grade 1, type 7, function 08 x push pad type(630)
(both leafs)
Exit Device Trim: (2) Match Von Duprin Model No. 996L w/lever style #07
Meeting Style: (2) Pemko 29326CP-2
Closer/Holder: (2) C00231 with options:
(both leafs) PT-4D, PT-4K, PT-4M, PT-4N and PT-4P (689)
Floor Stop (2) L02141 attach w/ expansion anchor
Gasket: Match Pemko S88BL

HW-10 (Wood Door)
Door No.: **1B, 4B, 7B, 10B, 100A, 100E, 100F, 100J, 101, 105**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Exit Device: (1) Grade 1, type 1, function 08 x push pad type(630)
Exit Device Trim: (1) Match Von Duprin Model No. 996L w/lever style #07
Closer (1) C02021 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Gasket: Match Pemko S88BL

HW-11 (Wood Door)
Door No.: **102A, 102B, 102C, 104A, 104B, 104C**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F76, Grade 1, privacy, lever
(Best No. 16 or equal) (630)

HW-12 (Wood Door)

Door No.: **103A, 103B, 103C, 103D**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F75, Grade 1, passage, lever
(Best No. 16 or equal) (630)
Deadbolt: (1) E0141
Floor Stop (1) L02141 attach w/ expansion anchor
Gasket: Match Pemko S88BL

HW-13 (Wood Door - Classroom/Office)
Door No.: **107, 109, 110, 111, 112, 113, 114, 116, 117, 119A, 119B, 120, 130A, 130B, 131A, 131B, 137A, 137B, 139, 142, 143, 145, 146, 147, 149A, 149B, 149C**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F84, Grade 1, classroom, lever
(Best No. 16 or equal) (630)
Closer (1) C02011 with options PT-4C and PT-4D (689)
Wall Stop (1) L02101 attach w/ wood screw into blocking
(except classrooms)
Floor Stop (1) L02141 attach w/ expansion anchor
(at classrooms)
Gasket: Match Pemko S88BL

HW-14 (Wood Door)
Door No.: **115A**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F84, Grade 1, classroom, lever
(Best No. 16 or equal) (630)
Closer/Holder (1) C00231 with options:
PT-4D, PT-4K, PT-4M, PT-4N and PT-4P (689)
Wall Stop (1) provide bumper on countertop nose
Gasket: Match Pemko S88BL

HW-15 (Wood Door - Child/Staff Toilet)
Door No.: **108, 143B**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F76, Grade 1, privacy, lever
(Best No. 16 or equal) (630)
Closer (1) C02011 with options PT-4C and PT-4D (689)
(at 108 only)
Floor Stop (1) L02141 attach w/ expansion anchor
Mop Plate: (1) J103 with option B3E, mount on pull side (630)
Gasket: Match Pemko S88BL

HW-16 (Wood Door - Multipurpose rooms))
Door No.: **125A, 125B, 133A, 133B**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Exit Device: (1) Grade 1, type 1, function 08 x push pad type(630)
Exit Device Trim: (1) Match Von Duprin Model No. 996L w/lever style #07
Closer (1) C02021 with options PT-4C and PT-4D (689)
Wall Stop (1) L02101 attach w/ wood screw into blocking
Gasket: Match Pemko S88BL

HW-17 (Wood Door - Toilet and Wuzu)
Door No.: **121, 122, 123, 126, 132, 136,**

Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F75, Grade 1, passage, lever
(Best No. 16 or equal) (630)
Deadbolt: (1) E0171
Closer (1) C02011 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Mop Plate: (1) J103 with option B3E, mount on pull side (630)
Gasket: Match Pemko S88BL

HW-18 (Wood Door - Shower)
Door No.: **124**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F76, Grade 1, privacy, lever
(Best No. 16 or equal) (630)
Deadbolt: (1) E0171
Closer (1) C02021 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Mop Plate: (1) J103 with option B3E, mount on pull side (630)
Gasket: Match Pemko S88BL

HW-19 (Wood Door - Janitor)
Door No.: **134**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86, Grade 1, Storeroom, lever
(Best No. 16 or equal) (630)
Closer (1) C02021 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Armour Plate: (1) J101 with option B3E, mount on push side
700 mm height (630)
Gasket: Match Pemko S88BL

HW-20 (Wood Door - Telecom)
Door No.: **128**
Hinges: (1 1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F05 with lever handle
(Best No. 16 or equal) (630)
Closer: (1) C02021 with options PT-4C and PT-4D (689)
Smoke Gasketing: Match Pemko S88BL
Balanced Magnetic
Switch: (1) coordinate placement of BMS at door head
BMS is connected to intrusion Detection
System (see Section 13721)

HW-21 (Wood Door - Storage)
Door No.: **110A, 110B, 115B, 130C, 138A, 138B, 149D**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86, Grade 1, Storeroom, lever
(Best No. 16 or equal) (630)
Floor Stop (1) L02141 attach w/ expansion anchor
Gasket: Match Pemko S88BL

HW-22 (Wood Door - Worship Storage)
Door No.: **100K**

Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86, Grade 1, Storeroom, lever
(Best No. 16 or equal) (630)
Closer (1) C02011 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Gasket: Match Pemko S88BL

HW-23 (Wood Door - Coats)
Door No.: **118, 141**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86, Grade 1, Storeroom, lever
(Best No. 16 or equal) (630)
Closer/Holder (1) C00191 with options:
PT-4D, PT-4K, PT-4M, PT-4N and PT-4P (689)
Gasket: Match Pemko S88BL

HW-24 (Wood Door - Kitchen)
Door No.: **135, 138**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F84, Grade 1, classroom, lever
(Best No. 16 or equal) (630)
Closer (1) C02011 with options PT-4C and PT-4D (689)
Floor Stop (1) L02141 attach w/ expansion anchor
Mop Plate: (1) J103 with option B3E, mount on pull side (630)
Gasket: Match Pemko S88BL

HW-25 (Wood Door Pair - Closet)
Door No.: **131C (active leaf on right)**
Hinges: (3 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86 with lever handle
(active leaf) (Best No. 16 or equal) (630)
Half Dummy Trim: (1) Match lever and rose (interior only)
(inactive leaf)
Surface Bolt: (2) L04161 at head and sill (626 or 630)
(inactive leaf)
Floor Stop (2) L02141 attach w/ expansion anchor

HW-26 (Wood Door Pair - Kitchen Pass thru)
Door No.: **138C (active leaf on right)**
Hinges: (3 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86 with lever handle
(active leaf) (Best No. 16 or equal) (630)
Half Dummy Trim: (1) Match lever and rose (exterior only)
(inactive leaf)
Astragal: (1) Pemko: 355PWS - paint to match door
Closer/Holder: (1) C00231 with options:
PT-4D, PT-4K, PT-4M, PT-4N and PT-4P (689)
Coordinator: (1) Ives: COR52
Floor Stop (2) L02141 attach w/ expansion anchor

HW-27 (Integrated Door Assembly- Double Egress)
Door No.: **4A, 7A**

All hardware provided/coordinated by door system manufacturer.
Electromagnetic
Release Devices: (2) C00011

HW-28 (Hollow Metal Pair - Corridor Closure)
Door No.: **1A, 10A**
Hinges: (2) Continuous aluminum geared hinge
(both leafs) (Stanley No. 662HD or equal) (673)
Exit Device: (1) Grade 1, type 3, function 08 x push pad type(630)
(right leaf)
Exit Device: (1) Grade 1, type 8, function 08 x push pad type(630)
(left leaf) (latches remain retracted when door open
latches deploy on head strike contact)
Exit Device Trim: (2) Match Von Duprin Model No. 996L w/lever style #07
Astragal: (1) Pemko: 355 CS
Electromagnetic
Release Devices: (2) C00011
Push buttom: (2) wall mounted push button for release of ERDs
Coordinator: (1) Ives: COR52

HW-29 (Hollow Metal Door - Equipment Platform)
Door No.: **129A**
Hinges: (1-1/2 pr.) 114mm x 114mm A5111 (630)
Lockset: (1) F86, Grade 1, Storeroom, lever
(Best No. 16 or equal) (630)
Closer (1) C02021 with options PT-4C and PT-4D (689)
Gasket: Match Pemko S88BL

HW-30 (Wood Door Pair - Ark Cabinet in Room 133)
Door No.: **NA**
Hinges: (3 pr.) 114mm x 114mm A1133 (630)
Mortise Deadlock: (2) E06081, at Head and Sill of active leaf (630)
Drop-ring pull (2) J404, recessed type (630)
Magnetic Catch (1) E09011 mount at head
Surface Bolt: (3) L04131, mount inside doors, at head and sill of inactive leaf and sill of active leaf. Provide additional floor strikes to hold doors at full open (180 degree) position.

HW-31 (Wood Door Pair - Storage under Activity Platform)
Door No.: **NA (total of 6 pairs)**
Hinges: (3 pr.) 114mm x 114mm A1133 (630)
Bored Deadlock: (1) E0151, at meeting jamb, active leaf (630)
Surface Bolt: (1) L04131, inside door, at head of inactive leaf
Roller Latch: (1) L07081, at meeting jamb
Silencers: (2) One each door at head.

3.8 LAWNMOWER STORAGE BUILDING HARDWARE SET (LSHW)

LSHW-1

Hinges: (2) Continuous aluminum geared hinge
(both leafs) (Stanley No. 662HD or equal) (673)

Lockset: (both leafs)	(1)	F07 with lever handle (630) (Best No. 16 or equal)
Half Dummy Trim (inactive leaf)	(1)	Match lever and rose (interior only)
Closer:	(2)	C02061 with options PT-4C and PT-4D (689)
Stop/Holder:	(2)	L01371 (626 or 630)
Surface Bolt: (inactive leaf)	(2)	L04161 at head and sill (626 or 630)
Astragal:	(1)	Match Pemko 355PWS - paint to match door
Threshold:		Match Pemko 157A
Weatherstripping:		Match Pemko S88BL
Door Bottom:	(2)	Match Pemko 216AV

3.9 MANUFACTURER LISTINGS

Manufacturer's items listed in hardware sets are used to provide clarification of design where BHMA numbering is not available, or may be ambiguous. Submittal of another manufacturer's product(s) conforming to the inherent and specified characteristics of the product indicated is acceptable.

-- End of Section --

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1994) Safety Glazing Materials Used in Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C 1036	(2001) Flat Glass
ASTM C 1048	(1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C 1172	(2003) Laminated Architectural Flat Glass
ASTM C 1184	(2000ae1) Structural Silicone Sealants
ASTM C 1376	(2003) Standard Specification For Pyrolytic And Vacuum Deposition Coatings On Flat Glass
ASTM C 509	(2000) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 669	(2000) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 864	(1999) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 395	(2003) Rubber Property - Compression Set
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 1300	(2003) Determining Load Resistance of Glass in Buildings
ASTM E 773	(2001) Accelerated Weathering of Sealed Insulating Glass Units

ASTM E 774	(1997) Classification of the Durability of Sealed Insulating Glass Units

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual
GANA Sealant Manual	(1990) Sealant Manual
GANA Standards Manual	(2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

SIGMA A1202	(1983) Commercial Insulating Glass Dimensional Tolerances
SIGMA TB-3001	(1990) Guidelines for Sloped Glazing
SIGMA TM-3000	(1997) Glazing Guidelines for Sealed Insulating Glass Units

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252	(2003) Fire Tests of Door Assemblies
NFPA 257	(2000) Fire Test for Window and Glass Block Assemblies

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-378	(Basic; Notice 1) Putty Linseed Oil Type, (for Wood-Sash-Glazing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

Elevation (Decorative Glass); G

Drawing(s) showing complete dimensioned elevation of decorative glass window. After approval of basic layout, provide full color artwork indicating entire window color/pattern.

SD-03 Product Data

Insulating Glass; G

Decorative Glass; G

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass; G

Decorative Glass; G

Glazing Compound

Glazing Tape

Sealant

Provide 200 x 200 mm samples of clear insulating glass units. Provide 300 x 300 mm samples, or larger as necessary to show all color and pattern types, of decorative insulating glass units with translucent pattern/color interlayer.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

Glazing Accessories

Certificates from the manufacturer attesting that the units meet the luminous and solar radiant transmission requirements for heat

absorbing glass.

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

SD-12 LEED Documentation

Manufacturing Plant Location; G
Regionally Extracted Materials; G

Manufacturer's statement of location of the manufacturing plant where glazing is produced, and percentage of glazing's raw materials extracted regionally in accordance with LEED-NC RG

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 4 degrees C and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.6 WARRANTY

1.6.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass

breakage, for a 5-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

1.7 Decorative Glass Designer

Manufacturer of laminated glass with translucent color interlayer (decorative glass) shall utilize a staff graphic designer to finalize window design and coordinate production. Designer shall have at least 3 years recent experience in the design detailing and fabrication of decorative glass windows of the size and type required for this project. Provide locations, photos and point of contact phone number of at least widnow projects similar to this project.

1.8 Decorative Glass Manufacturer Qualifications

Manufacturer of decorative glass shall have at least 3 years of manufacturing experience with this product.

1.9 Decorative Glass Design/Submittals Meeting

Within 90 days following contract award, and prior to preparation of any submittals, a design completion/submittals meeting shall be held to discuss and coordinate decorative glass design and fabrication. The specific system(s) of the proposed manufacturer and installer shall be reviewed for conformance with the design and integrated with project design requirements. Attendance by contractor, installer, manufacturer's representative, Fort Lewis representative(s), government construction administrators, and project designers is required.

1.10 Decorative Glass Sample Panels

Sample panels shall be prepared to demonstrate typical pattern, color, translucency and standard of workmanship. Samples shall be approved before any window fabrication is begun. Approved samples will be used as a standard to judge the work.

1.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of glass and glazing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verification that glazing channel surfaces are properly prepared

to receive installation of glazing.

(5) Finished appearance of glazing is consistent with specification.

(6) Windows and glazed surfaces are cleaned.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 GLASS

ASTM C 1036, unless specified otherwise. At interior doors, sidelights, transom lights and windows provide safety glazing (fire protection rated at fire rated openings, tempered elsewhere) material conforming to 16 CFR 1201. At exterior doors, sidelights, transom lights and windows provide insulating glass units with laminated glazing as specified.

2.1.1 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, minimum 89 percent visible light transmittance, 0.95 shading coefficient, conforming to ASTM C 1036. All annealed glass shall have a minimum thickness of 6 mm.

2.1.2 Wired Glass

Wired glass is not permitted.

2.1.3 Laminated Glass

ASTM C 1172, Kind LA fabricated from two nominal 3 mm pieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C 1036. Flat glass shall be laminated together with a minimum of 0.75 mm thick, clear polyvinyl butyral interlayer. The minimum total thickness shall be 6 mm. Thicker glass may be required to meet loading conditions listed in SECTION 08520 ALUMINUM WINDOWS and to meet requirements of SECTION 08911 GLAZED ALUMINUM CURTAIN WALL. Use of 7/32 inch total thickness laminated glass in lieu of 6 mm is not permitted.

2.1.4 Laminated Glass with Translucent Color Interlayer (Decorative Glass)

Fabricate with two layers of 3 mm minimum thickness heat strengthened glass consistent with paragraph 2.1.7. Minimum total thickness shall be 6 mm. Interlayer shall be imprinted thermoplastic, minimum 1.7 mm thick and designed for use in laminated glass applications. Colors and pattern shall be as indicated in drawings attached to this section (see attachments A, B anc C). Contractor is responsible for design completion actions necessary to resolve sketch into a completed window design.

Reference Interlayer Manufacturers:
Cesar Color: ChromaFusion

Dupont: SentryGlas Expressions
Solutia: Vanceva

2.1.5 Mirrors

2.1.5.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.1.6 Tempered Glass

ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (transparent), Quality q3, 6 mm minimum thickness, 89 percent visible light transmittance, 0.95 shading coefficient conforming to ASTM C 1048 and GANA Standards Manual. Color shall be clear.

2.1.7 Heat-Strengthened Glass

ASTM C 1048, Kind HS (heat strengthened), Condition A (uncoated), Type I, Class 1 (clear), Quality q3, 6 mm minimum thickness for non-laminate applications. Provide where heat strengthened glass as indicate and as required by industry practices to meet specified performance.

2.1.8 Fire Protection Rated Glass

Fire protection rated glass shall be a wireless glass ceramic meeting test requirements for NFPA 252, NFPA 257, ASTM E 119 as required by code and labeled for the fire ratings indicated. Thickness as standard with the manufacturer. Glass shall be able to resist thermal shock. Glass shall also be impact safety rated meeting ANSI Z97.1. Visible light transmittance shall be at least 85 percent. Glass shall have a 20 minute rating at doors in one hour rated walls, 60 minute rating at locations indicated, and 90 minute rating at two hour fire walls. Glass shall be permanently labeled (etched) with appropriate markings. Example products: (Up to 1 hour) "Firelite Plus" by Technical Glass Productsor approved equal. (At 90 minute locations) Pilkington Pyrostop or approved equal.

2.1.9 Obscure Glass

Obscure glass shall be provided at the interior (laminated) pane. Pane shall be as specified for laminated glass except a diffused white polyvinyl butyryl (PVB) interlayer shall be used. Light transmittance shall be 65%.

Provide at locations indicated.

2.1.10 Solar Control Low-E Glass

Glass shall be manufactured to conform to ASTM C 1376 and provide a clear, low reflective exterior appearance. Pane shall be sputter coated with a low emissivity coating. When tested in a 25 mm insulated section with clear glass, a 6 mm thick section shall meet or exceed the following performance characteristics:

K-Value/Winter Nighttime:	1.70 maximum
Shading coefficient:	0.50 maximum
Solar Heat Gain Coefficient:	0.40 minimum
Visible Light Transmittance:	50 percent minimum

2.2 INSULATING GLASS UNITS (IGU)

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in SIGMA A1202. The units shall conform to ASTM E 773 and ASTM E 774, Class A. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 IGU Locations

IGU shall be used at all exterior glazing locations (doors, sidelights, transoms, and windows, including clerestory windows).

2.2.2 IGU Composition

Provide nominal 13 mm airspace, total IGU thickness shall be nominal 25 mm. The inner pane shall be ASTM C 1172 Laminated Glass as specified. The outer pane shall be ASTM C 1036, Type I, Class 1 (transparent), Quality q3, 6 mm thick with Solar Control low-E anti-reflective coating on No. 2 surface, except for the following locations:

a. Where safety glazing is required (such as doors and sidelights) provide ASTM C 1172 Laminated Glass in outer and inner panes.

b. Where obscure glass is required, provide obscure in the inner pane of the laminated panel.

c. Where decorative glass is used low-E coating is not required.

2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, SIGMA TM-3000, SIGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.3.1 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.3.2 Glazing Compound

ASTM C 669. Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.3.3 Sealants

Provide elastomeric and structural sealants.

2.3.3.1 Elastomeric Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. Color of sealant shall be as selected.

2.3.3.2 Structural Sealant

ASTM C 1184.

2.3.4 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

2.3.5 Sealing Tapes

Preformed, semisolid, polymeric-based material of proper size and compressibility for the particular condition. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.3.6 Setting Blocks and Edge Blocks

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

2.3.7 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking

projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.3.7.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

2.3.7.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

2.3.7.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.8 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

2.4 MIRROR ACCESSORIES

2.4.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2 Mirror Frames

Framed mirrors are specified in SECTION 10800 TOILET ACCESSORIES.

2.4.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips. Clips for frameless mirrors shall provide anchorage to wall structure.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that openings and framing are correctly sized and within dimensional tolerances specified. Correct any conditions that could be detrimental to glass setting or the long term performance of the window units. Do not begin glass setting prior to correction of identified problems.

3.2 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.3 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, SIGMA TB-3001, SIGMA TM-3000, and manufacturer's recommendations. Aluminum windows and wood doors may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

3.3.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.3.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of SIGMA TB-3001 and SIGMA TM-3000.

3.3.3 Installation of Laminated Glass

Sashes which are to receive laminated glass shall be weeped to the outside to allow water drainage into the channel.

3.4 CLEANING

Do not remove manufacturer's identifying labels from glass prior to obtaining written approval from Contracting Officer. Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to

prevent staining. Glass shall be clean at the time the work is accepted.

3.5 PROTECTION

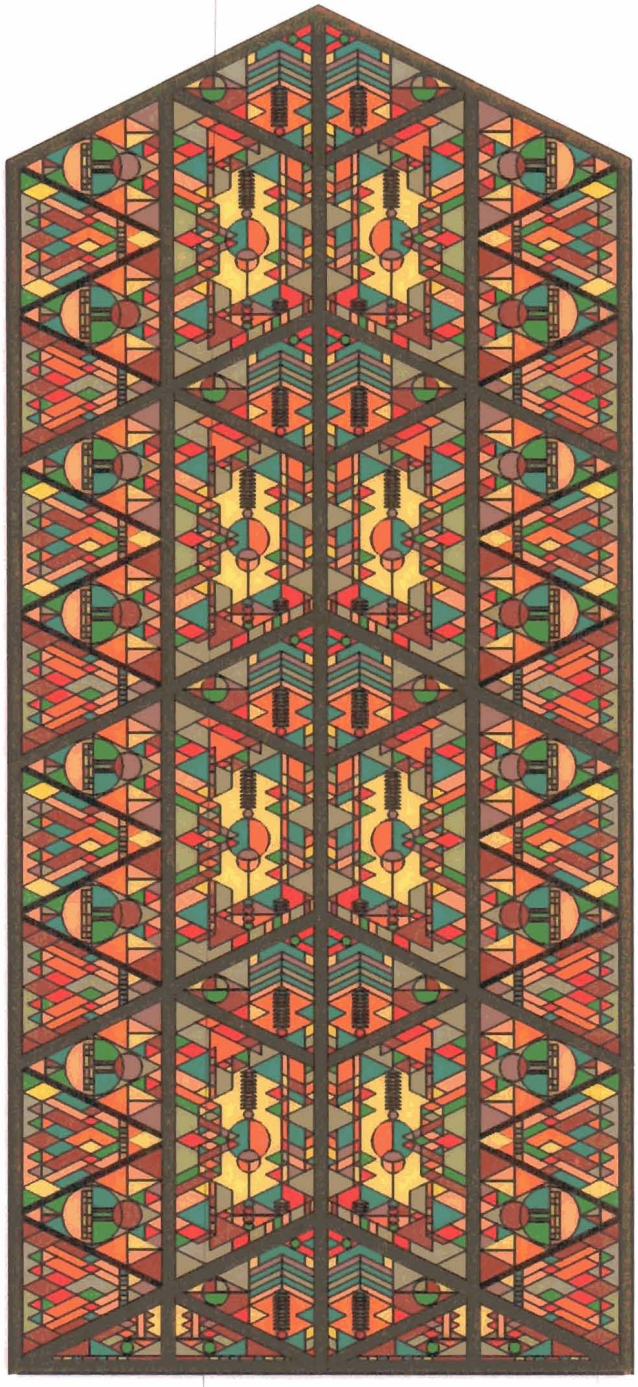
Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

3.6 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

PRODUCTS	INCH-POUND	METRIC
Glass	1/8 inch	3 mm
	3/16 inch	4.5 mm
	7/32 inch	5.5 mm
	1/4 inch	6 mm
	3/8 inch	10 mm
Interlayer	0.015 inch	0.38 mm
Glazing Channels	1/4 inch	6 mm

-- End of Section --

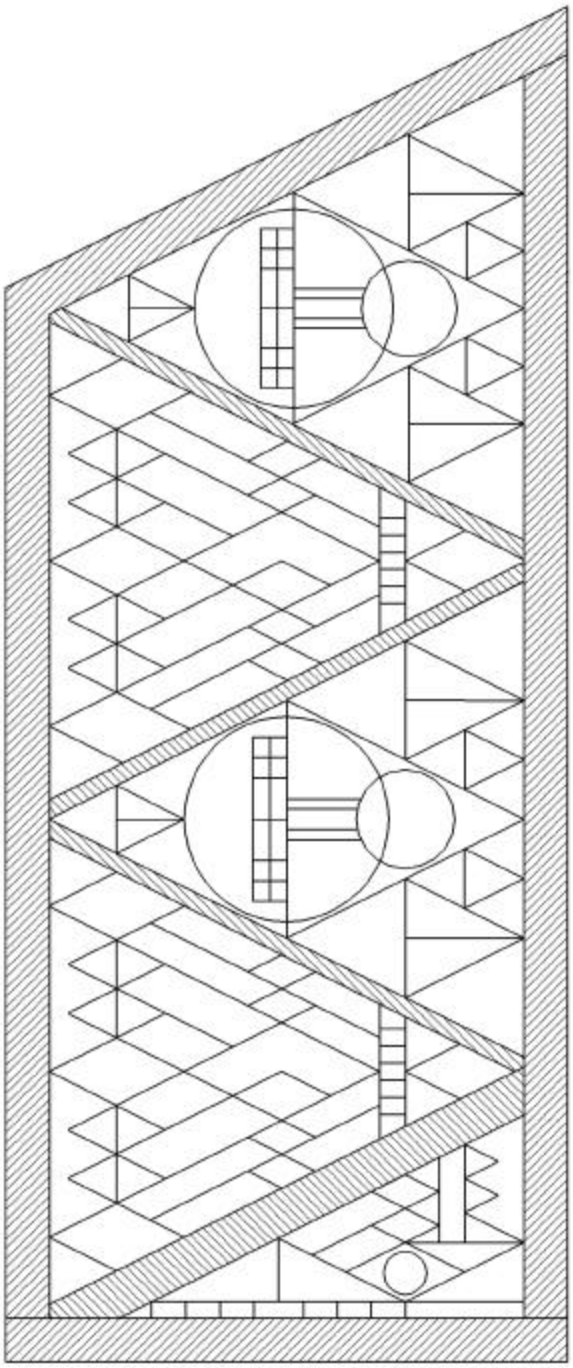


LAMINATED GLASS WITH TRANSLUCENT
COLOR INTERLAYER (DECORATIVE GLASS)

WINDOW MARK W3 ON EXTERIOR FINISH SCHEDULE
(NOT TO SCALE)

FY05 CHAPEL COMPLEX, FORT LEWIS
WASHINGTON

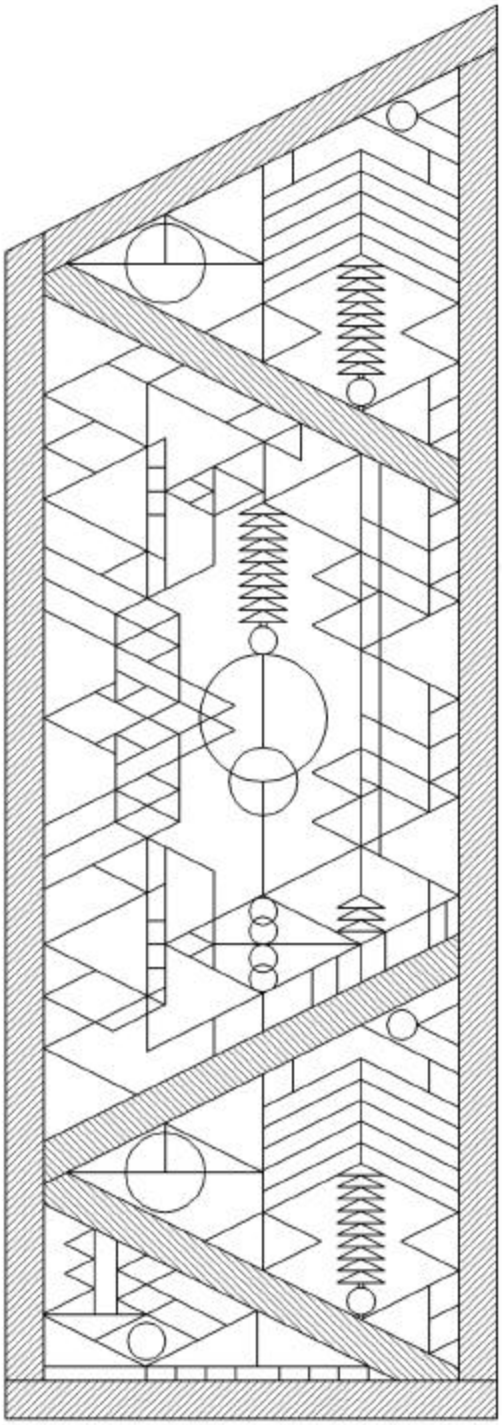
SECTION 8800 ATTACHMENT A



ENLARGED VIEW LAMINATED GLASS PANEL
WITH TRANSLUCENT COLOR INTERLAYER
(DECORATIVE GLASS)

WINDOW MARK W3 ON EXTERIOR FINISH SCHEDULE
(NOT TO SCALE)

FY05 CHAPEL COMPLEX, FORT LEWIS
WASHINGTON



ENLARGED VIEW LAMINATED GLASS PANEL
WITH TRANSLUCENT COLOR INTERLAYER
(DECORATIVE GLASS)

WINDOW MARK W3 ON EXTERIOR FINISH SCHEDULE
(NOT TO SCALE)

FY05 CHAPEL COMPLEX, FORT LEWIS
WASHINGTON

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SECTION 08911

GLAZED ALUMINUM CURTAIN WALL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ASD1	(2003) Aluminum Standards and Data
AA DAF-45	(2003) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501	(1994) Methods of Test for Exterior Walls
AAMA 609/610	(2002) Cleaning and Maintenance Guide for Architecturally Finished Aluminum
AAMA 611	(1998) Voluntary Specification for Anodized Architectural Aluminum; includes 604.2, 606.1, 607.1 and 608.1 (which are no longer available as separate documents)
AAMA 800	(1992) Voluntary Specifications and Test Methods for Sealants
AAMA CW-10	(1997) Care and Handling of Architectural Aluminum from Shop to Site
AAMA MCWM-1	(1989) Metal Curtain Wall Manual

AMERICAN WELDING SOCIETY (AWS)

AWS A5.10/A5.10M	(1999) Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 424	(2000) Steel, Sheet, for Porcelain Enameling
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled
ASTM A 572/A 572M	(2003a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 611	(1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 108	(2003a) Aluminum-Alloy Permanent Mold Castings
ASTM B 136	(1984; R 2003) Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B 137	(1995; R 2000) Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B 152M	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar (Metric)
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 244	(1997; R 2002) Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM B 85	(2003) Aluminum-Alloy Die Castings
ASTM C 236	(1989; R 1993e1) Steady-State Thermal

	Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 542	(1994; R 1999) Lock-Strip Gaskets
ASTM C 864	(1999) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM E 283	(1991; R 1999) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(2002) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 34	(1994; R 2002) Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E 546	(1988; R 1999e1) Frost Point of Sealed Insulating Glass Units
ASTM E 576	(1988; R 1999e1) Frost Point of Sealed Insulating Glass Units in the Vertical Position
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM	(1988)Metal Finishes Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Glazed curtain wall system; G

Submit for curtain wall system, accessories, and mock-up sample. Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings will be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

SD-03 Product Data

Glazed curtain wall system; G

Include descriptive literature, detailed specifications, and available performance test data.

SD-04 Samples

Glazed curtain wall system mock-up; G

Finish, assembly and appearance of frame and insulated glass with integral color pattern.

SD-05 Design Data

Structural calculations or test reports; G

Submit calculations or test reports demonstrating that frames, mullions, window hardware and frame anchors meet design load requirements specified. Calculations shall be signed by a licensed engineer. Test reports shall be provided by a nationally recognized testing agency.

SD-08 Manufacturer's Instructions

Glazed curtain wall system

Insulating glass

1.3 REQUIREMENT FOR DESIGN DATA

Submit structural and thermal calculations for complete wall assembly.

1.4 QUALITY ASSURANCE

1.4.1 Testing Requirements

The components listed below shall have been tested in accordance with the requirements below, and shall meet performance requirements specified.

a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.

b. Preformed Compression Gaskets and Seals: ASTM C 864.

c. Preformed Lock-strip Gaskets: ASTM C 542, modified as follows: Heat age specimens seven days at 70 degrees C, in zipped or locked position under full design compression. Unzip, cool for one hour, re-zip, and test lip seal pressure, which shall be minimum 0.045 kilograms per linear millimeter on any extruded or corner specimen.

d. Anodized Finishes: Stain resistance, coating weight, and coating thickness tests, ASTM B 136, ASTM B 137, and ASTM B 244, respectively.

e. Insulating Glass: ASTM E 546 or ASTM E 576 at minus 29 degrees C, no frost or dew point.

1.4.2 Mockup

1.4.2.1 Construction

Construct at manufacturer's plant a mock up sample of a typical wall unit which incorporates horizontal and vertical joints, framing, panels, glazing, and other accessories as detailed and specified. Mock-up sample size shall be approximately 500 by 500 mm and design shall be as indicated.

1.4.2.2 Approved Mock-Up

After approval of product data test results, submit mock-up for approval. Approved mock-up shall be retained on site as a work standard reference. Finished work shall match approved mock-up.

1.4.3 Anti-Terrorism Requirements

In addition to industry standard loading and test criteria described below, the curtain wall system shall be designed to resist the following prescribed loads. Submit test reports or structural calculations demonstrating compliance.

Exterior frames, mullions, and window hardware shall be designed to resist equivalent static design loads of 7 kilopascals applied to the surface of the glazing. Frame and mullion deformations shall not exceed 1/60 of the unsupported member lengths. The Contractor must demonstrate by calculations or tests that the window complies with the loading requirement.

Equivalent static design loads for connections of window to the surrounding walls or hardware and associated connections, and glazing stop connections shall be 75 kilopascals for glazing panels with a vision area less than or

equal to 1.0 square meter and 30 kilopascals for glazing panels with a vision area greater than 1.0 square meter but less than or equal to 3.0 square meters. Alternatively, use frames that provide an equivalent level of performance.

1.4.4 Factory Tests

Perform the following tests except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested, under the conditions specified herein, the resulting test reports may be submitted in lieu of testing the components listed below:

1.4.4.1 Deflection and Structural Tests

No curtain wall framing member shall deflect, in a direction normal to the plane of the wall, more than 1/175 of its clear span or 20 mm, whichever is less, when tested in accordance with ASTM E 330, except that when a plastered surface will be affected the deflection shall not exceed 1/360 of the span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E 330 for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified.

1.4.4.2 Water Penetration Test

No water penetration shall occur when the wall is tested in accordance with ASTM E 331 at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 0.19 kPa. Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test.

1.4.4.3 Air Infiltration Test

Air infiltration through the wall, when tested in accordance with ASTM E 283, shall not exceed 0.005 cms per sq. m of fixed wall area, plus the permissible allowance specified for operable windows within the test area.

1.4.4.4 Thermal Conductance Tests

The average calculated thermal transmittance of the complete wall assembly including panels, windows, and all other components shall not exceed a U-value of 0.65. Determine U-values of components in accordance with ASTM C 236.

1.4.4.5 Window Tests

Windows shall meet the requirements specified in 08800 GLAZING, except where the requirements of this section differ, this section shall govern. Windows shall meet the same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with ASTM E 330 except permanent deformation shall not exceed 0.4 percent; there

shall be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Windows shall have no water penetration when tested in accordance with ASTM E 331.

1.4.4.6 Sound Transmission Loss Test

Sound transmission loss (TL) of the wall shall be less than 30 db, when tested in accordance with ASTM E 90 for the frequency range from 125 to 4000 Hz.

1.5 CURTAIN WALL SYSTEM REQUIREMENTS

Provide system complete with framing, mullions, trim, panels, glazing, sealants, insulation, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

1.5.1 Source

Curtain wall system components shall be furnished by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

1.5.2 Design

Stick system with mullions, rails and panels as indicated. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified. System design performed by registered Structural Engineer.

1.5.3 Thermal Movement

Fabricate, assemble, and erect system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -12 degrees C to 38 degrees C.

1.5.4 Tolerances

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

a. Maximum variation from plane or location shown on approved shop drawings: one millimeter per 12 meters of length up to not more than 13 mm in any total length.

b. Maximum offset from true alignment between two identical members abutting end to end in line: 2 mm.

1.5.5 Structural Requirements

Meet structural performance requirements for loads resulting from Anti-Terrorism standards indicated in paragraph 1.4.3. In addition, no member shall deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. No member after deflection under full design load, shall have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than 3 mm. Design entire system to withstand the indicated wind and concentrated loads, and the following wind loads acting normal to the plane of the wall:

a. 0.51 kPa acting inward, and the same load acting outward.

1.6 QUALIFICATION OF WELDERS

Welding shall be performed by certified welders qualified in accordance with AWS D1.1/D1.1M using procedures, materials, and equipment of the type required for the work.

1.7 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces shall be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Deliver calking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

1.7.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of aluminum with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering shall not chip, peel, or flake due to temperature or weather, shall protect against discoloration and surface damage from transportation, and storage, and shall be resistant to alkaline mortar and plaster. Do not cover aluminum surfaces that will be in contact with sealants after installation.

1.7.2 Identification

Prior to delivery, mark wall components to correspond with shop and erection drawings placement location and erection.

1.8 WARRANTY

Insulating glass units shall be guaranteed not to develop material obstruction of vision as a result of dust or film formation on the inner glass surface caused by failure of the seal, other than through glass breakage, within a period of 5 years from date of acceptance of work by the Government. Units failing to comply with the terms of this guarantee shall

be replaced with new units without additional cost to the Government. The Contractor shall require the manufacturer to execute their warranties in writing directly to the Government.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum

Shall be free from defects impairing strength or durability of surface finish. Standard alloys shall conform to standards and designations of AA ASD1. Special alloys, not covered by the following ASTM specifications, shall conform to standards and designations recommended by the manufacturer for the purpose intended.

2.1.1.1 Wrought Aluminum Alloys

Shall be those which include aluminum alloying elements not exceeding the following maximum limits when tested and additional in accordance with ASTM E 34. These limits apply to both bare products and the core of clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited structural uses where special appearance is required:

ALLOY	PERCENT
Silicon	1.5
Magnesium, Manganese, and Chromium combined	6.0
Iron	1.0
Copper	0.4
Zinc	1.0

Within the chemical composition limits set forth above, wrought aluminum alloys shall conform to the following:

a. Extruded bars, rods, shapes and tubes: ASTM B 221M.

b. Sheet and Plate: ASTM B 209M.

2.1.1.2 Cast Aluminum Alloys

Provide those in which the alloying elements are silicon, magnesium, manganese, or a combination of these. Other elements shall not exceed the following limits:

ELEMENT	PERCENT
Iron	1.2
Copper	0.4
Nickel	0.4
Titanium	0.2
Others (total)	0.5

Within the chemical composition limits set forth above, cast aluminum alloys shall conform to the following:

a. Sand castings: ASTM B 26/B 26M.

b. Die casting: ASTM B 85.

c. Permanent mold castings: ASTM B 108.

2.1.1.3 Welding Rods and Electrodes

Welding rods and bare electrodes shall conform to AWS A5.10/A5.10M as recommended by the manufacturer of the aluminum base metal alloy being used.

2.1.1.4 Organic Coating Finish

Organic coating shall be a high performance fluorocarbon complying with the requirements of AAMA 2605. Finish coat of 70% fluorocarbon resin over manufacturer's standard surface primer. Dry film thickness shall be at least 1.0 mil. Color coating shall be on exterior surfaces only. Color as indicated.

2.1.1.5 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF-45 and AAMA 611. Finish shall be:

a. Architectural Class II (0.01 to 0.0175 mm), designation AA-M10-C22-A32, integral color or -A34, electrolytically deposited color anodized. Anodized coating shall be on interior surfaces only. Color shall be dark bronze.

2.1.1.6 Strength

Aluminum extrusions for framing members used in curtain walls and main frame and sash or ventilator members in windows shall have a minimum ultimate tensile strength of 152 MPa and minimum yield strength of 110 MPa.

2.1.2 Bronze

Bronze sheets, tubes, and drawn shapes shall be commercial bronze, alloy

No. 220. Extruded shapes shall be architectural bronze, alloy No. 385. Rolled or drawn rods shall be commercial bronze, alloy No. 220 or architectural bronze, alloy No. 385.

2.1.3 Copper

Conform to ASTM B 152M, hot or cold-rolled of the temper suitable for the respective forming operations.

2.1.4 Carbon Steel

Conform to the following specifications:

a. Rolled shapes, plates, and bars: ASTM A 36/A 36M.

b. Galvanized sheets: ASTM A 653/A 653M.

c. Sheets for porcelain enameling: ASTM A 424.

d. Other sheets: ASTM A 570/A 570M or ASTM A 611.

2.1.5 Stainless Steel

Conform to ASTM A 167, Type 302 or 304, and finish in accordance with the NAAMM MFM conform to Metal Finishes Manual as follows:

a. Concealed flashings: Dead soft fully annealed, 2 D finish.

b. Exposed work: No. 4 finish to match approved sample.

2.1.6 Weathering High-Strength Low-Alloy Steel

Weathering steel is not permitted.

2.1.7 High-Strength, Low-Alloy Steel

Conform to ASTM A 572/A 572M for structural shapes, plates, and bars.

2.1.8 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the AAMA MCWM-1. Fastener metals used in connection with weathering steel shall be of type recommended by the weathering steel manufacturer. Metals used for fasteners shall be chemically and galvanically compatible with contiguous materials.

2.1.9 Joint Sealants and Accessories

Provide manufacturer's standard colors as closely matching the adjacent surfaces as possible.

2.1.9.1 Elastomeric, Single or Multiple Component

ASTM C 920, Type S, single component. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

2.1.9.2 Single Component Silicone Rubber Base

ASTM C 920, Type S, Grade NS (Silicone).

2.1.9.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, tests related to that material shall include primer.

2.1.9.4 Backing Material

Provide material which is nonstaining, nonabsorbent, and compatible with sealing compound. Closed cell resilient urethane, polyvinylchloride or polyethylene foam; closed-cell sponge of vinyl or rubber; closed cell neoprene or butyl rod; or polychloroprene tubes or beads.

2.1.9.5 Bond Preventive Materials

Provide polyethylene tape with pressure-sensitive adhesive; aluminum foil or waxed paper.

2.1.9.6 Preformed Sealing Compound

Provide nonskinning type conforming to AAMA 800. Tapes, beads, ribbons or other shapes as required.

2.1.10 Glass and Glazing

Materials are specified under Section 08800 GLAZING. Specialty colored PVB interlayer is required in laminated glazing. All glazing material must be certified as meeting 16 CFR 1201.

2.1.10.1 Glass Sizes and Clearances

Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip to remove flares or to reduce oversized dimensions.

2.1.10.2 Glass Setting Materials

a. Sealants and preformed sealing compounds: Shall be as specified under paragraph entitled "Joint Sealant and Accessories."

b. Preformed compression gaskets and seals: ASTM C 864, color black.

c. Preformed lock-strip type gaskets: ASTM C 542, factory formed,

color black. Provide separate filler or locking strips, approximately 10 Shore "A" Durometer points harder than gasket body, and insure permanent and continuous pressure of sealing lips. Grooves and ends shall be square butted or mitered 45 degrees.

d. Setting blocks, edge blocks, and spacer shims: Fabricate from neoprene or other materials recommended by glass manufacturer compatible with compounds, sealants, or gaskets used. Unless otherwise recommended by the glass manufacturer, shore "A" Durometer hardness for setting and edge blocks shall be 90 plus or minus 5; for spacer shims, 50 plus or minus 5.

2.1.11 Paint and Finishes

2.1.11.1 Primer

Zinc-molydate, alkyd type for concealed surfaces.

2.1.12 Panels

Maximum U-value 65. Where, in order to meet the requirements specified, the proposed panel assembly is thicker than indicated, make corresponding adjustments in accessories and other work such as flashing, coping, and trim products at no extra cost to the Government. Unless otherwise indicated, design for installation from outside the building. Seal edges of panels with cores of absorptive material to prevent entrance of water and allow venting of the core space to outside air.

2.1.12.1 Adhesively Bonded Panels

Adhesively bonded panels shall be sandwich type, metal faced both sides, and bonded to form stable and composite unit. Nonexposed face shall be aluminum of the thickness indicated. Exposed face shall be aluminum of thickness indicated, with continuous laminated backing or internal stiffening ribs or breaks spaced as required to meet flatness specified. Maximum slope of exposed face surface at any point, measured from nominal plane, shall not exceed the following:

a. 1.0 percent for high reflectivity finish.

b. 1.25 percent for medium reflectivity finish.

c. 1.5 percent for low reflectivity finish.

2.1.13 Metal Accessories

Fascias, flashings, metal sills, metal stools, closures,and soffits as necessary to complete the design as detailed. Fabricate accessories of sizes and shapes indicated from similar materials and finish as specified for curtain wall system.

PART 3 EXECUTION

3.1 FABRICATION

The curtain wall components shall be of the materials and thickness indicated or specified. The details indicated are representative of the required design and profiles. Acceptable designs may differ from that shown if the proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly shall be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Anchorage devices shall permit adjustment in three directions. Exposed fastenings used on finished surfaces shall be truss head, flat head, or oval head screws or bolts. Review drawings for indication/location of structural and non-structural (applied) mullions.

3.1.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving calking or sealing material shall be minimum 20 mm deep and 10 mm wide at mid ambient temperature range.

3.1.2 Welding

Conform to AWS D1.1/D1.1M. Use methods and electrodes recommended by manufacturers of base metal alloys. Welding rods shall be of an alloy that matches the color of the metal being welded. Protect glass and other finish from exposure to welding spatter. Ground and finish weld beads on exposed metal surfaces to minimize mismatch and to blend with finish on adjacent parent metal. If flux is used in welding aluminum, completely remove it immediately upon completion of welding operations. Do not use exposed welds on aluminum surfaces.

3.1.3 Soldering and Brazing

Provide as recommended by suppliers. Solder only for filling or sealing joints.

3.1.4 Ventilation and Drainage

Provide internal ventilation drainage system of weeps or based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.

3.1.5 Protection and Treatment of Metals

3.1.5.1 General

Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving the shop.

3.1.5.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate calking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

3.1.5.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with preservative incompatible with aluminum, apply two coats of aluminum paint, to such materials and seal joints with approved calking compound.

3.2 INSTALLATION

Installation and erection of glazed wall system and all components shall be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator and applicable portions of AAMA Aluminum Curtain Wall Design Guide Manual.

3.2.1 Bench Marks and Reference Points

Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of the marks, stop erection work in that area until discrepancies have been corrected.

3.2.2 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in the building frame.

3.2.3 Panels

Install panels in framing member openings using gaskets and sealants as indicated or specified.

3.2.4 Joint Sealants

3.2.4.1 Surface Preparation

Surfaces to be primed and sealed shall be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm. Do not apply compound unless ambient temperature is between 4 and 32 degrees C. Clean out loose particles and mortar just before

sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.

3.2.4.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters.

3.2.4.3 Primer

Apply to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after calking is completed.

3.2.4.4 Backing

Tightly pack in bottom of joints which are over 13 mm in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

3.2.4.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

3.2.4.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of calking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

3.2.5 Glass

Install in accordance with manufacturer's recommendations as modified herein.

3.2.5.1 Inspection of Sash and Frames

Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3.2.5.2 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

3.2.5.3 Positioning Glass

Set glass from inside the building unless otherwise indicated or specified. Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than 1270 united millimeters, provide setting blocks at sill and spacer shims on all four sides; locate setting blocks one quarter way in from each jamb edge of glass. Where setting blocks and spacer shims are set into glazing compound or sealant, butter with compound or sealant, place in position, and allow to firmly set prior to installation of glass.

3.2.5.4 Setting Methods

Apply glazing sealant, glazing tape, and gaskets, as required by manufacturer's standard system, uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners, and solvents. Strip surplus sealants from both sides of glass and tool at slight angle to shed water and provide clean sight lines. Secure stop beads in place with suitable fastenings. Do not apply sealant at temperatures lower than 4 degrees C, or on damp, dirty, or dusty surfaces. Glazing system shall be a compression type design with compression gaskets both sides of glass. Exterior gasket shall be replaceable. Internal sealants, if required, shall remain elastic, and non-migrating.

3.2.5.5 Void Space

Heat absorbing, insulating, spandrel, and tempered glass, and glass of other types that exceed 2540 united millimeters in size: Provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

3.2.5.6 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system. The weeping of lock-strip gaskets should be in accordance with the recommendation of the glass manufacturer.

3.2.5.7 Insulating Glass With Edge Bands

Insulating glass with flared metal edge bands set in lock-strip type gaskets: Follow glass manufacturer's recommendations and add supplementary wet seal as required; when used with glazing tape, use tapered tape.

3.3 FINISHES

3.3.1 Galvanizing

Conform to ASTM A 123/A 123M, ASTM A 153/A 153M, and ASTM A 653/A 653M, as applicable.

3.3.1.1 Repair of Zinc-Coated Surfaces

Repair zinc coated surfaces damaged by welding or other means with galvanizing repair paint or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved.

3.3.2 Shop Cleaning and Painting

3.3.2.1 Cleaning

Clean steel and iron work by power wire brushing or other approved manual or mechanical means, for removal of rust, loose paint, scale, and deleterious substances. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other foreign matter, with solvents until thoroughly clean. Cleaning steel embedded in concrete is not required.

3.3.2.2 Painting Steel or Iron Surfaces

Apply one coat of primer. Apply additional shop coat of specified paint, to which a small amount of tinting material has been added, on surfaces that will be concealed in the finished construction or that will not be accessible for finish painting. Accomplish painting in dry weather or under cover, and on steel or iron surfaces that are free from moisture and frost. Do not paint surfaces of items to be embedded in concrete. Recoat damaged surfaces upon completion of work. Prime coat steel immediately after cleaning. Do not apply bituminous protective coatings to items to be finish painted.

3.4 FIELD TESTS

Conduct field check test for water leakage on designated wall areas after erection. Conduct test on two separate wall areas, where directed. Conduct test and take necessary remedial action as described in AAMA 501.

3.5 CLEANING AND PROTECTION

3.5.1 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

3.5.2 Aluminum Surfaces

Protection methods, cleaning, and maintenance shall be in accordance with AAMA 609/610 and AAMA 609/610.

3.5.3 Other Metal Surfaces

After installation, protect glass, panels, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of the respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or the respective trade association.

-- End of Section --

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SECTION 09100

METAL SUPPORT ASSEMBLIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 463/A 463M	(2002a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 645	(2003) Nonstructural Steel Framing Members
ASTM C 754	(2000) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 841	(2003) Installation of Interior Lathing and Furring

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal support systems; G

Submit for the erection of metal framing, furring, and ceiling suspension systems. Indicate materials, sizes, thicknesses, and fastenings.

SD-07 Certificates

Steel Framing; G

Certificates stating that the steel framing meets the specified requirements.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where metal support assemblies are produced, and percentage of metal support assemblies' raw materials extracted regionally in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for metal support assembly products.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

1.5 RELATED SECTIONS

This section covers products to be used in non-load bearing, interior ceiling assemblies. See SECTION 05400 Cold Formed Metal Framing for steel framing used in miscellaneous load bearing construction.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A 653/A 653M, Z180; aluminum coating ASTM A 463/A 463M, T1-75 ; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 645. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of L/240. Carrying channels shall be formed from minimum 1.40 mm (16 gauge) thick cold-rolled steel, 38 x 19 mm. Furring members shall be formed from cold-rolled steel, 22 x 65 mm. Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, except as indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 754, except that framing members shall be 400 mm o.c. unless indicated otherwise. Suspended ceiling system framing shall be installed in accordance with ASTM C 754 and IBC 2000.

1) Hangers

Hangers shall be spaced not more than 1200 mm along runner channels and 900 mm in the other direction or 1050 mm in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists that develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced. Install suspension system with seismic restraint hangers as required by IBC 2003.

2) Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 150 mm of the paralleling wall to support the ends of cross furring. Main runners shall not come in

contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3) Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 50 mm of parallel walls and beams, and shall be cut 13 mm short of abutting walls.

4) Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2 ERECTION TOLERANCES

Framing members which shall be covered by finish materials such as wallboard or plaster, shall be within the following limits:

a. Layout of walls and partitions: 6 mm from intended position;

b. Plates and runners: 5 mm in 1.9 meters from a straight line;

c. Studs: 5 mm in 1.9 meters out of plumb, not cumulative; and

d. Face of framing members: 5 mm in 1.9 meters from a true plane.

-- End of Section --

SECTION 09215

VENEER PLASTER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 36/C 36M	(2001) Gypsum Wallboard
ASTM C 442/C 442M	(2001) Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board
ASTM C 475/C 475M	(2002) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(2001) Nails for the Application of Gypsum Board
ASTM C 587	(2002) Gypsum Veneer Plaster
ASTM C 588/C 588M	(2001) Gypsum Base for Veneer Plasters
ASTM C 630/C 630M	(2001) Water-Resistant Gypsum Backing Board
ASTM C 631	(1995a; R 2000) Bonding Compounds for Interior Gypsum Plastering
ASTM C 754	(2000) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 843	(1999e1) Application of Gypsum Veneer Plaster
ASTM C 844	(1999) Application of Gypsum Base to Receive Gypsum Veneer Plaster
ASTM C 954	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 1002	(2001) Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood

	Studs or Steel Studs
ASTM C 1047	(1999) Accessories for Gypsum Wallboard and Gypsum Veneer Base

FM GLOBAL (FM)

FM P8016	(1994) Specification Tested Products Guide

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(2004) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Except where otherwise indicated or specified, conform to ASTM C 754, ASTM C 843, and ASTM C 844. Apply the gypsum veneer plaster as a two coat system over a special gypsum base. The veneer plaster, gypsum base, and joint reinforcement shall be products of the same manufacturer. The extent and location of veneer plaster shall be as shown on the drawings. Wood framing is specified in Section 06100 ROUGH CARPENTRY. Metal framing is specified in Section 09100 METAL SUPPORT ASSEMBLIES.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

Drawings showing ceiling framing and furring, special wall framing, and framed openings.

SD-03 Product Data

Gypsum base; G

Gypsum veneer plaster; G

Descriptive data and installation instructions.

SD-07 Certificates

Fire Resistive Construction; G

Certificates attesting that fire-resistive partitions meet the ratings shown.

1.4 DELIVERY AND STORAGE

Deliver and store plaster materials in the manufacturer's original unopened containers. Store materials off the ground within a completely enclosed structure or enclosed within a weathertight covering. Store gypsum base and gypsum backing board flat to prevent warping and protect from excessive exposure to sunlight.

1.5 SCHEDULING

Commence application only after the area scheduled for veneer plaster work is completely weathertight. The heating, ventilating, and air-conditioning systems should be complete and in operation prior to application of the plaster. If the mechanical system cannot be activated before veneer plastering is begun, the plastering may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply plaster prior to the installation of finish flooring and acoustic ceiling.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum base to excessive sunlight prior to plaster application, as bond failure of the plaster may result. Maintain a continuous uniform temperature of not less than 10 degrees C and not more than 27 degrees C for at least one week prior to the application of veneer plaster, while the plastering is being done, and for at least one week after the plaster is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during plaster application and set, and until plaster is dry. In glazed areas, keep windows open top and bottom or side to side 75 to 100 mm. Openings can be reduced in cold weather. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 10 degrees C or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following plastering and until plaster is dry.

1.7 FIRE RESISTIVE CONSTRUCTION

Build partitions and ceilings indicated to be of fire resistive construction in compliance with the drawings. For fire-rated assembly comply with the specifications contained in UL Fire Resist Dir, or FM P8016 for the Design Numbers indicated.

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of veneer plaster with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Methods of installation comply with this section and industry standards.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Partition and shaft wall enclosures meet or exceed the referenced UL fire resistance directory design.

(6) Suspended ceiling and wall framing is adequately braced as necessary to prevent failure or cracking at joints and seams.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the requirements specified below. Miscellaneous items not otherwise specified shall be as recommended by the veneer plaster system manufacturer and approved prior to use. Powder driven fasteners may be used only when approved in writing.

2.1.1 Vapor Retarder

Foil-backed gypsum base or gypsum backing board, or 4-mil polyethylene.

2.1.2 Gypsum Backing Board

ASTM C 36/C 36M, ASTM C 442/C 442M or ASTM C 630/C 630M, Type X. Provide boards with square edges as the first ply in two-ply application. Provide 1200 mm wide boards, thickness as shown except that board used for liner panels and core plies of shaftwall construction shall be the size and thickness recommended by the system manufacturer.

2.1.3 Gypsum Base

ASTM C 588/C 588M, Type X, 1200 mm wide, thickness as shown. Provide square edges, rounded, or tapered as recommended by the veneer plaster manufacturer.

2.1.4 Gypsum Veneer Plaster

ASTM C 587. Minimum compressive strength of finish coat plaster shall be 17 MPa.

2.1.5 Joint Reinforcement

ASTM C 475/C 475M, Mesh reinforcing strip or paper tape minimum 50 mm wide perforated cross fibered as recommended by the veneer plaster manufacturer.

2.1.6 Joint Compound

ASTM C 475/C 475M.

2.1.7 Screws

ASTM C 1002 or ASTM C 954, type appropriate to use.

2.1.8 Nails

ASTM C 514, with corrosion-resistant treatment.

2.1.9 Corner Bead, Casing Bead, and Control Joints

ASTM C 1047, Corrosion protective-coated steel as recommended by the veneer plaster manufacturer. Provide flanges free of any material that would adversely affect bonding of the plaster.

PART 3 EXECUTION

3.1 WOOD FRAMING

Typical wall construction is wood frame. See Section 06100 ROUGH CARPENTRY. Space framing at 400 mm on center maximum.

3.2 STEEL FRAMING

ASTM C 754. Use of steel framing is permitted only in those locations indicated on drawings. Space framing at 400 mm on center maximum.

3.2.1 Special Framing

Build framing for soffits, and other special items to the sizes, shapes, or forms indicated. Secure rigidly at each intersection with wallboard screws.

3.2.2 Ceiling Support Suspension Systems

Space furring channel members 400 mm on center, except as otherwise indicated. Install auxiliary framing at termination of veneer plaster work, as required for support of both gypsum base and other work indicated for support from gypsum base.

3.2.3 Ceiling Openings

Provide support members at ceiling openings such as required for access panels, recessed light fixtures, and for air supply or exhaust. Locate support members of not less than 38 mm main runner channels and suspension wires or straps to provide at least the minimum support specified herein for furring and wallboard attachment. Provide intermediate structural members for attachment or suspension of support members.

3.2.4 Blocking

Provide blocking when mounting equipment. Cut metal blocking to fit in between the framing members. Rigidly anchor blocking to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to the veneer plaster system.

3.3 APPLICATION OF GYPSUM BASE

Apply gypsum base and gypsum backing board to framing and furring members in accordance with ASTM C 844 and the requirements specified herein. Gypsum wallboard may be used for the base ply in two-ply construction. Provide gypsum base and backing board of maximum practical length, using full length boards for vertical application. Install separate boards in moderate contact without forcing in place. Install boards tight against the framing so as to eliminate any offset in the face plane between adjoining boards. Stagger end joints of adjoining boards. Fit abutting end and edge joints. Cut boards as required to make close joints around openings. Gypsum base may be adhered to gypsum backing board with an adhesive, except where prohibited by fire rating. In multi-layer construction, offset joints between layers. Offset joints on opposite faces of the partition.

3.3.1 Ceiling Panels

Install ceiling panels in the direction and manner that will minimize the number of end butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 300 mm.

3.3.2 High Wall Areas

At stairs and similar high wall areas (in excess of 4000 mm) install panels horizontally with end joints staggered over studs.

3.3.3 Isolation

Isolate edges of gypsum base from abutment with structure, except at floors. Provide 6 mm to 12 mm space for trim and sealant, except as otherwise indicated. Seal space with acoustical sealant, coordinated with trim.

3.3.4 Sound Rated Walls

At all walls indicated for sound control or specific acoustic performance, seal the work at all perimeter edges (including openings and penetrations) with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with manufacturer's recommendations for location of beads, and close off sound flanking paths around or through the work. Apply serpentine bead of sealant, 6 mm minimum diameter under floor track. Provide a similar bead under ceiling or wall track where junction is not otherwise sealed. Where casing bead is used to finish gypsum base at junction of wall or ceiling, provide continuous bead of sealant located so the inner edge of casing bead compresses the sealant. At edge of gypsum base adjacent to floor, apply a bead of sealant before setting base, except

at carpeting. Seal around all electrical outlet boxes and other penetrations. Space fasteners in gypsum base in accordance with referenced standards and manufacturer's recommendations, except as other wise indicated.

3.3.5 Curved Surfaces

Use bending radii in accordance with ASTM C 844, TABLE 5. Bend gypsum base into place without damaging the face paper. If the base is dampened to facilitate bending, dry thoroughly, and apply a bonding agent (ASTM C 631) before plastering.

3.3.6 Cavity Shaftwall System

Install gypsum backing boards, core boards, and gypsum base in accordance with the shaftwall system manufacturer's printed recommendations to achieve the fire rating required.

3.3.7 Control Joints

Control joints in ceilings and walls shall be one piece manufactured products designed for use with a veneer plaster system. Joints shall not be spaced more than 9000 mm on center.

3.3.8 Vapor Retarder

Install foil-backed gypsum base or gypsum backing board with the reflective surface against the framing members. Install polyethylene vapor retarder with joints over framing members, and with joints lapped the full width of the framing members.

3.4 JOINT REINFORCEMENT

Reinforce all interior angles and flat joints prior to application of the veneer plaster. Do not use self-adhering mesh. Reinforcement shall be a special mesh reinforcing strip embedded in veneer plaster, or gypsum wallboard joint tape embedded in joint compound.

3.4.1 Mesh Reinforcing

Embed the mesh reinforcing strip in veneer plaster, so that embedment material is both under and covering the reinforcement. Allow areas of reinforcement to preset, and leave rough enough for proper bonding of the plaster coat. Reinforcement shall be set but not dry, before the application of veneer plaster.

3.4.2 Paper Tape Reinforcing

Press the paper tape into a bedding coat of setting type joint compound, and immediately cover with a skim coat of the same compound. After the bedding and skim coats are set, apply a fill coat of joint compound. Set the reinforcement and dry thoroughly before application of veneer plaster.

3.5 APPLICATION OF GYPSUM VENEER PLASTER

3.5.1 Substrate Preparations

Where veneer plastering or skim coat plastering is shown directly on concrete, masonry or similar substrates, clean and remove surface projections, which might interfere with plaster application. Etch substrate by scrubbing with acid etch solution on previously wetted surface; rinse thoroughly with clean water. Apply bonding agent on dried concrete substrates; comply with manufacturer's instructions. Where veneer plastering shown on gypsum substrates other than gypsum base of the same manufacturer as the plaster, apply bonding agent.

3.5.2 General Plastering Standards

Except where more stringent requirements are indicated, comply with plaster manufacturer's instructions, referenced standards and requirements for fire-resistance ratings, whichever is the most stringent. Grout metal door frames and similar units occurring in the veneer plastering systems, using grout materials recommended by the manufacturer. Grout prior to gypsum base installation where necessary for proper access. Grout frames solidly and continuously where indicated or required for fire-resistance ratings. Omit grout at closed, tubular frames where moisture from grout may not escape.

3.5.3 Plastering

Apply gypsum veneer plaster in accordance with ASTM C 843, and with the manufacturer's approved installation instructions where such instructions are additional to or more restrictive than the requirements of ASTM C 843. Apply plaster as a two-component system. Minimum plaster thickness shall be as recommended by the manufacturer, but shall in no case be less than 1.6 mm for base coat and 0.8 mm for finish coat of a two-component system.

3.5.4 Mixing

Clean mixer between batches to avoid accelerating the setting time. Do not add other plaster materials to modify the properties of the veneer plaster. When extreme conditions so demand, small quantities of commercial retarder or accelerator may be added to the mixing water to adjust setting time. When used, the retarder or accelerator shall conform to the veneer plaster manufacturer's recommendations.

3.5.5 Application

Trowel plaster on by hand. Apply with sufficient material and pressure to develop bond and to provide the specified component thickness.

3.5.5.1 Base Coat

Scratch in the base coat tightly, then immediately double back using material from the same batch. Fill all voids and imperfections and level the plaster to a true surface without the application of water. For good bond or adhesion, roughen the final surface for bond by brushing or cross-raking with a fine wire rake. For application of finish coat, set

the base coat and partially dry. If the base coat is totally dry, dampen before finish coat application.

3.5.5.2 Finish Coat

Scratch in the finish coat tightly, then immediately double back using material from the same batch. After the plaster has been allowed to set up slightly, lightly trowel the surface without the addition of water, filling all voids and imperfections and eliminating surface irregularities. When the plaster has become firm and prior to set, smooth-trowel the surface using water sparingly. Avoid over troweling. Allowable finished tolerance shall be not more than 3 mm total offset in 2400 mm for plumb, level, warp and bow. No visible grooves or trowel marks shall be apparent after finish coat installation.

3.6 CLEANUP AND PATCHING

Remove plaster splashes from adjacent surfaces. Repair defects in the veneer plaster. Plaster surfaces shall be smooth, clean, and in condition to receive the finishing materials that will be applied.

-- End of Section --

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SECTION 09225

STUCCO (PORTLAND CEMENT PLASTER)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A118.9	(1999) Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM C 91	(2003a) Masonry Cement
ASTM C 150	(2002ae1) Portland Cement
ASTM C 206	(2003) Finishing Hydrated Lime
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 841	(2003) Installation of Interior Lathing and Furring
ASTM C 847	(1995; R 2000) Metal Lath
ASTM C 897	(2000) Aggregate for Job-Mixed Portland Cement-Based Plasters
ASTM C 926	(1998a) Application of Portland Cement-Based Plaster
ASTM C 933	(1996a; R 2001) Welded Wire Lath
ASTM C 1032	(1996; R 2002) Woven Wire Plaster Base
ASTM C 1063	(2003) Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster

ASTM C 1116	(2003) Fiber-Reinforced Concrete and Shotcrete
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
U. S. GREEN BUILDING COUNCIL	
LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Stucco System

Drawings showing details of construction for reinforcement, furring, and grounds; including detailed description of the proposed job-mix proportions for base and finish coats; including identification of thickness of coats and locations where each mix and coating thickness will be used.

SD-03 Product Data

Materials

Manufacturers product literature and installation instructions for stucco materials. Manufacturers product literature and installation instructions for additives and proprietary materials.

SD-04 Samples

Colored Stucco Finish Coat

Samples including both a fabricated portion of unit of work and color samples.

One 300 mm square stucco panel showing finish texture and color and exposed reinforcement at the edges, one 300 mm square of reinforcement, and a 300 mm length of each accessory proposed, prior to proceeding with stucco work.

A sample panel of stucco, constructed at the jobsite, and integrated with the brick veneer sample panel, to demonstrate installation procedures, texture and color, prior to proceeding with any stucco work. Panel size shall be a minimum of 1200 x

2400 mm high; shall contain each type accessory proposed for use and shall be constructed in the vertical position. Sample panel shall have exposed reinforcement at the edges. Each phase of installation such as framing, scratch coat, brown coat, finish coat and curing procedures shall be demonstrated in the construction of the panel. One 300 mm square of reinforcement and one 300 mm length of each accessory proposed for use, shall be submitted prior to constructing the sample panel.

SD-07 Certificates

Stucco Materials;
Acrylic Finish Material;
Joint and Trim Materials;
Cementitious Backer Unit;
Weather-Resistant Barrier;
Fasteners and Anchors;

Certificates stating that the materials meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

SD-12 LEED Documentation

Recycled Content; G,
Manufacturing Plant Location; G,
Regional Material Extraction; G,

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where masonry veneer was produced, and percentage of the product's raw materials extracted regionally in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for masonry products.

1.4 DELIVERY AND STORAGE

Packaged materials shall be delivered to the site in the original packages and containers with labels intact and seals unbroken. Cementitious materials shall be kept dry and stored off the ground under cover away from damp surfaces until ready to be used. Aggregate shall be covered to prevent the absorption or loss of moisture.

1.5 ENVIRONMENTAL CONDITIONS

Stucco shall not be applied when the ambient temperature is 4 degrees C or

lower, or when a drop in temperature below 4 degrees C is expected within 48 hours after application. Do not use frozen materials in mix. Do not apply cement plaster to frozen surfaces. In hot, dry or windy weather protect stucco from uneven and/or excessive evaporation.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of masonry with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Pre-installation coordination meeting with all affected trades.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Sample panels are built and provided with all features of the wall construction as indicated.

(6) Stucco installation is coordinated with interfacing construction to eliminate conflicts.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 CEMENTITIOUS BACKER UNIT

Panel composed of portland cement, aggregates and glass fiber reinforcement that can be nail or screw attached to framing, nominal 13 mm thick. Product shall be manufacturer recommended for exterior exposure and unaffected by prolonged exposure to moisture. Meet ANSI A118.9 standard. Fiber cement products are not acceptable.

2.2 WEATHER-BARRIER BACKING

Meet Federal Specification UU-B-790a, style 2, grade D asphalt saturated kraft paper. Water vapor permeable with 60 minute water resistance.

2.3 FLASHING PAPER

Vapor barrier coated and reinforced, Grade A or B, self adhesive.

2.4 PORTLAND CEMENT

Portland cement shall conform to ASTM C 150, gray portland cement Type I.

2.5 MASONRY CEMENT

Masonry cement shall conform to ASTM C 91, Type I.

2.6 ACRYLIC FINISH COAT

Acrylic stucco finish coat shall be 100% pure acrylic polymer base with integral color and aggregate. Color shall be as indicated.

2.7 LIME

Lime shall conform to ASTM C 206, Type S.

2.8 SAND

Sand aggregate for job-mixed base coat and job-mixed finish coat stucco shall conform to ASTM C 897.

2.9 Admixtures

Only admixtures specifically manufactured for use with stucco and approved for this project shall be used. Household type detergents or chlorides are prohibited.

2.9.1 Fibers

For use in basecoats only, polypropylene, nylon or alkali-resistant class fibers 13 mm long conforming with ASTM C 1116

2.9.2 Air-entraining

In amounts as recommended by manufacturer and conforming with ASTM C 260

2.9.3 Water-reducing

In amounts as recommended by manufacturer and conforming with ASTM C 494/C 494M, Type A.

2.9.4 Accelerating

In amounts as recommended by manufacturer, non-chloride type and conforming with ASTM C 494/C 494M, Types C and E.

2.10 ACCESSORIES

Accessories shall be rigid polyvinyl chloride (PVC) or zinc alloy, except that cornerite and striplath shall be formed from steel sheets with manufacturer's standard galvanized coating. Vinyl members shall be in accordance with ASTM D 1784. Welded wire corner reinforcements shall be zinc coated, galvanized 1.4 mm (17 gauge) steel wire conforming to ASTM A 185. Accessories shall have a finish surface lip flange and/or embedment flange designed to key into cement plaster. Furring shall include hangers,

bolts, inserts, clips, fastenings, and attachments of number, size, and design to develop the full strength of the members.

2.11 STEEL FRAMING

Miscellaneous steel framing shall be as shown and shall be manufacturers standard products with shop applied protective coating.

2.12 METAL LATH

Metal lath shall conform to ASTM C 847, types and weights in accordance with the various spacing shown in ASTM C 841. Woven wire lath shall be a maximum 38 x 38 mm mesh wire of not less than 1.37 mm nominal diameter and shall conform to ASTM C 1032. Welded wire lath shall conform to ASTM C 933, with openings not to exceed 50 x 50 mm. Expanded metal or wire lath shall be fabricated in a manner to provide not less than 6 mm keying between wire and paper backing and keying shall be obtained by a uniform series of slots in a perforated face paper woven between the wires.

2.13 FASTENERS

All fasteners shall be corrosion resistant.

Nails meeting Federal Specification FF-N-105
Staples meeting Federal Specification FF-N-105
Screws meeting Federal Specification ASTM C 646

2.14 WATER

Water shall be clean, fresh, potable, and free from amounts of oils, acids, alkalis and organic matter that would be injurious to the stucco.

2.15 MIX DESIGN

2.15.1 General

Size stucco batches for complete use within one hour of mixing. Accurately measure proportions of materials for each batch using measuring devices of known volume. Proportions indicated are parts by volume.

2.15.2 Mix Proportions

Mix shall be selected from one of the three listed below. Only one mix shall be used for the entire project. Do not interchange components.

Mix No. 1

Portland Cement	1
Masonry Cement	1
Sand	4-5
Fibers	per manufacturer's recommendation
Water	

Mix No. 2

Portland Cement	1

Lime	0.25-0.5
Sand	3-4
Fibers	per manufacturer's recommendation
Water	

Mix No. 3

1-P Portland Cement	1
Masonry Cement	1
Sand	3.5-4.5
Fibers	per manufacturer's recommendation
Water	

PART 3 EXECUTION

3.1 EXAMINATION

Prior to the start of stucco work inspect the substrate and all adjacent work to verify that predecessor installation activities have been completed. Do not begin work if conditions detrimental to proper stucco installation exist. Notify the C.O.R. in writing if detrimental conditions exist.

3.2 WALL CONSTRUCTION

Framing, sheathing, furring and cementitious backer units shall be installed as indicated to form rainscreen wall construction. Spacing of furring shall not exceed 410 mm. Furring shall be installed to true lines and surfaces and shall be rigidly supported and secured in place by fastening to underlying studs. CBU shall be screw attached as recommended by manufacturer.

3.3 WEATHER-BARRIER BACKING

Apply two layers of weather-barrier backing shingle fashion over CBU. Lap vertical edges 150 mm and horizontal edges 50 mm minimum. Lap weather-barrier backing over flashing to prevent entrance of moisture and ensure drainage. Weather-barrier backing shall be continuous under trim joints.

3.4 CONTROL JOINTS

Control joints shall be located as indicated on the drawings. Control joints shall also be located at joints between dissimilar substrates and at any surface penetration created by windows, doors, electrical and mechanical devices. Verify proper spacing of sheathing and CBU prior to joint placement. Locate and install prefabricated control joint members prior to the application of the stucco. Control joints shall be cleared of all stucco within the control area after stucco application and prior to final stucco set.

3.5 FLASHING AND TRIM ACCESSORIES

All flashing and trim shall be installed by the stucco installer. Install

foundation weep screeds, casing beads, corner reinforcement, control and expansion joints, reveals and similar items as necessary for a complete installation. Shim trim accessories to match stucco thickness. Sections of trim that butt each other shall be lapped, caulked or covered with self-adhering membrane to limit moisture entry. Lap edges and ends of trim and co-fasten to limit opportunity for differential movement.

3.6 LATH

Lath shall be installed in accordance with ASTM C 841 or ASTM C 1063 except as otherwise specified. Metal and wire lath shall be applied straight, without buckles and with joints staggered. End laps of metal lath shall be not less than 25 mm. Horizontal joints shall be shiplapped. Lath shall be interrupted at all control joints. Attach lath and accessories to substrate so that they are secure, level, plumb and true. Develop proper screed and depth for installation of stucco.

3.6.1 CBU/Wood Supports

Metal lath over solid CBU and wood backing frame construction shall be applied only after a backing of shiplapped weather-barrier backer has been applied to the area to receive the stucco. Lath shall be secured to the CBU with nails or screws spaced every 200 mm vertically and every 400 mm horizontally. Where sheets of lath are lapped, fasteners shall be driven so as to hold both lapped edges securely in place.

3.6.2 Over Metal Lintels and Flashings

Lath over metal lintels shall be extended vertically over the angles to a height of not less than 150 mm and horizontally across the underside of the lintels and shall be secured in an approved manner. Lath over metal flashings shall lap the flashings not less than 50 mm and shall be extended vertically for a height of not less than 150 mm.

3.6.3 Special Shapes, Profiles, and Contours

Special shapes, profiles, and contours shall be formed with wood, metal or aluminum furring and reinforcing.

3.6.4 Attachment

Fasten lath to substrate such that it is taut and connected through furring. Fasteners shall be long enough to penetrate CBU, furring and plywood sheathing with minimum length of 50 mm.

3.7 PREPARATION OF SURFACES

Preparation of surfaces for application of stucco to solid bases shall conform to the applicable requirements of ASTM C 926.

3.8 PROPORTIONS AND MIXING

Proportions and mixing for job-mixed base coats shall conform to the applicable requirements of ASTM C 926. Sequential batches shall be

proportionally alike. Use a mechanical mixer. Mix for 3 to 5 minutes after all ingredients have been added. Add fiber 2 to 3 minutes prior to completion of mixing. Use enough water to produce a suitably plastic mix while keeping total water use to a minimum. Materials shall be added in the following sequence: 1 - water, 2 - half of sand, 3 - all of cement and lime, 4 - balance of sand, and 5 - water necessary for workability.

3.9 STUCCO APPLICATION

Stucco shall be applied in three coats to a thickness of not less than 25 m as measured from the back plane of metal reinforcement, exclusive of ribs or dimples or from the face of solid backing or support, with or without metal reinforcement, to the finished stucco surface, including moderate texture variations. Stucco application shall conform to the applicable requirements of ASTM C 926 and the following:

3.9.1 Workmanship

Items or features of the work in connection with or adjoining the stucco shall be in place, plumb, straight, and true prior to beginning the stucco work. Metal and wire lath, where required, shall be in place and positioned to provide a good key at back of lath. Where lath is applied over copper, the copper shall be given a heavy coat of bituminous paint. Masonry surfaces to receive stucco shall be evenly dampened immediately prior to application of stucco. Each stucco coat shall be applied continuously in one general direction, without allowing mortar to dry at edges. Where it is impossible to work the full dimension of a wall surface in a continuous operation, jointing shall be made at a break, opening, or other natural division of the surface. Edges to be joined shall be dampened slightly to produce a smooth confluence. Exterior corners of stucco shall be slightly rounded. Stucco on soffit surfaces shall be pitched forward to form a drip.

3.9.2 Scratch Coat

Scratch coat shall be applied not less than 10 mm nor more than 13 mm thick under sufficient pressure to form good keys and to completely embed the reinforcement. Before the scratch coat has set, it shall be lightly scratched in one direction and vertical surfaces shall be scratched in the horizontal direction only. The scratch coat shall be fog cured for a minimum of 72 hours.

3.9.3 Brown Coat

The scratch coat shall be dampened evenly to obtain uniform suction before the brown coat is applied. There shall be no visible water on the surface when the brown coat is applied. Brown coat shall be applied not less than 6 mm nor more than 10 mmthick. The brown coat shall be applied to the scratch coat with sufficient pressure to force the stucco into the scratches and shall be brought to a plumb, true, even plane with rod or straightedge. When set sufficiently, the brown coat shall be uniformly floated with a dry float to promote densification of the coat and to provide a surface receptive to bonding of the finish coat. Fill all voids and dress surface for as necessary for indicated texture and acrylic

finish. Brown coat shall be fog cured for a minimum of 72 hours. Completed stucco base coats shall cure for 10 to 14 days.

3.9.4 Acrylic Finish Coat

Acrylic finish coat shall be applied in a continuous, single operation to cover the entire wall area. Maintain a wet edge free of scaffold lines or other application irregularities. Minimum dry film thickness of finish coat shall be 2 mm. The finish coat shall result in a course sand float finish, color as indicated and shall conform to the approved sample and mock up panel. Care shall be taken to prevent staining.

3.9.5 Surface Tolerance

When a 3 m straightedge is placed at any location on the finished surface of the stucco, excluding rough-textured finish, the surface shall not vary more than 3 mm from the straightedge.

3.10 CURING AND PROTECTION

Fog curing shall be accomplished by applying a fine mist of water to the stucco. Care shall be exercised during fog curing to avoid erosion damage to the stucco surfaces. A solid stream of water shall not be used. Frequency of fogging shall be not less than three times daily. When directed the Contractor shall protect the stucco from the direct rays of the sun during severe drying conditions using canvas, cloth or other approved sheet material.

3.11 PATCHING AND POINTING

Loose, cracked, damaged or defective work shall be replaced or patched as directed. Patching shall match existing work in texture and color and shall be finished flush.

-- End of Section --

SECTION 09250

GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11	(1992) Interior Installation of Cementitious Backer Units
ANSI A118.9	(1999) Test Methods and Specifications for Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM A 853	(2004) Standard Specification For Steel Wire, Carbon, For General Use
ASTM C 1002	(2001) Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C 1047	(1999) Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C 1178/C 1178M	(2001) Glass Mat Water-Resistant Gypsum Backing Panel
ASTM C 1396/C 1396M	(2003) Gypsum Board
ASTM C 36/C 36M	(2001) Gypsum Wallboard
ASTM C 442/C 442M	(2001) Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board
ASTM C 475	(2002) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(2001) Nails for the Application of Gypsum Board
ASTM C 557	(2003) Adhesives for Fastening Gypsum

	Wallboard to Wood Framing
ASTM C 630/C 630M	(2001) Water-Resistant Gypsum Backing Board
ASTM C 840	(2003) Application and Finishing of Gypsum Board
ASTM C 954	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

GYPSUM ASSOCIATION (GA)

GA 214	(1996) Recommended Levels of Gypsum Board Finish
GA 216	(2000) Application and Finishing of Gypsum Board
GA 600	(2003) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(2004) Fire Resistance Directory

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Joints; G
Fire-Resistant Assemblies; G

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-03 Product Data

Cementitious backer units; G

Glass Mat Water-Resistant Gypsum Tile Backing Board; G

Water-Resistant Gypsum Backing Board; G

Glass Mat Covered or Reinforced Gypsum Sheathing; G

Glass Mat Covered or Reinforced Gypsum Sheathing Sealant; G

Accessories

Submit for each type of gypsum board and for cementitious backer units.

SD-04 Samples

Cementitious Backer Units; G

Submit for each type of board.

SD-07 Certificates

Asbestos Free Materials; G,

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where gypsum board was produced, and percentage of gypsum board's raw materials extracted regionally in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for gypsum board products.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation.

1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Temperature

Maintain a uniform temperature of not less than 10 degrees C in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

1.5.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

1.6 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

1.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of gypsum wallboard with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Partition, shaft, ceiling and fire wall enclosures meet the requirements of the UL Fire Resistance Directory as indicated.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Inspection of vapor retarder for completeness, integrity and seam closure, and repair of any damage found, prior to installation of wallboard.

(6) Finished surfaces meet criteria and design requirements.

(7) All concrete floors to remain exposed in finished construction shall be protected from staining or other contamination during gypsum wallboard installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified herein. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only. Miscellaneous items not otherwise specified shall be as recommended by the wallboard manufacturer and approved prior to use. The long edges of wallboard shall be tapered, except when used as a base layer in a double layer application. Power driven fasteners may be used only when approved in writing by the Contracting Officer's Representative. Thickness of wallboard shall comply with the systems and listed assemblies as detailed on the drawings.

2.1.1 Gypsum Board

ASTM C 36/C 36M and ASTM C 1396/C 1396M.

2.1.1.1 Regular

1200 mm wide, 16 mm thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

1200 mm wide, 16 mm thick, tapered edges.

2.1.2 Water-Resistant Gypsum Backing Board

ASTM C 630/C 630M

2.1.2.1 Regular

1200 mm wide, 16 mm thick, tapered edges.

2.1.2.2 Type X (Special Fire-Resistant)

1200 mm wide, 16 mm thick, tapered edges.

2.1.3 Glass Mat Water-Resistant Gypsum Tile Backing Board

ASTM C 1178/C 1178M

2.1.3.1 Regular

1200 mm wide, 16 mm thick, square edges.

2.1.3.2 Type X (Special Fire-Resistant)

1200 mm wide, 16 mm thick, square edges.

2.1.4 Abuse Resistant Gypsum Board

Abuse resistant gypsum board shall be manufactured to resist surface indentation, impact and surface abrasion with additives and surface papers/liners conforming to ASTM C 36/C 1396, Type X. Impact resistance by ASTM E 695 shall show no failures after 100 impacts. Impact/Penetration Resistance shall be not less than 8 kg. - meters when tested in accordance with ASTM D 2394, modified. Surface abrasion resistance as tested by ASTM D 4977, modified shall be not greater than .025 mm when tested for 250 cycles.

2.1.5 Shaftwall Liner Panel

Shaftwall liner panel shall conform to UL listing. Liner Panel shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, 25.4 mm thick, by 600 mm wide.

2.1.6 Cementitious Backer Units

ANSI A118.9. Cementitious backer units shall not contain organic fibers.

2.1.7 Joint Treatment Materials

ASTM C 475.

2.1.7.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.7.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.7.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.7.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.7.5 Joint Tape

Cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.8 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047. Corrosion protective coated steel designed for its intended use. Flanges shall be free of dirt, grease and other materials that may adversely affect the bond of joint treatment. Provide protective metal edging at corners, wall to concrete or precast concrete transitions, transitions to other dissimilar materials, edges of panels exposed to view and all other areas requiring a smooth finished appearance.

2.1.9 Soffit Metal Reveal Screed

Provide 19 mm reveal at soffit to brick veneer, fiber reinforced plastic (FRP) and precast concrete elements at all exterior gypsum soffit locations. Thickness of reveal shall be as required to provide a flush finish appearance.

2.1.10 Fasteners

2.1.10.1 Nails

ASTM C 514.

2.1.10.2 Screws

ASTM C 1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.84 mm thick. ASTM C 954 steel drill screws for fastening gypsum board to steel framing members 0.84 to 2.84 mm thick. Provide cementitious backer unit screws with a polymer coating.

2.1.10.3 Staples

1.5 mm thick flattened galvanized wire staples with 11.1 mm wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

Length of Legs (mm)	Thickness of Gypsum Board (mm)
29	13 (1/2 inch)
32	16 (5/8 inch)

2.1.11 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene.

2.1.11.1 Adhesive for Fastening Gypsum Board to Metal Framing

Type recommended by gypsum board manufacturer.

2.1.11.2 Adhesive for Fastening Gypsum Board to Wood Framing

ASTM C 557.

2.1.11.3 Adhesive for Laminating

For laminating two-ply gypsum board systems, provide adhesive recommended by gypsum board manufacturer.

2.1.12 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to ASTM A 853.

2.1.13 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580/A 580M, composition 302, 304, or 316, Condition A except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

2.1.13.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

2.1.13.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 3 mm thick or shall be hairpin clip, formed of wire not less than 0.4 mm nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

2.1.14 Gypsum Studs

25 mm minimum thickness and 150 mm minimum width. Studs may be of 25 mm thick gypsum board or multilayers laminated to required thickness. Conform to ASTM C 36/C 36M or ASTM C 442/C 442M for material.

2.1.15 Shaftwall Liner Panel

ASTM C 442/C 442M. Shaftwall liner panel shall conform to UL Fire Resist

Dir for the Design Number(s) indicated. Liner Panel shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, 25.4 mm thick, by 610 mm wide.

2.1.16 Accessories

ASTM C 1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.17 Water

Clean, fresh, and potable.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified herein. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings. Holes for pipes, fixtures or other small openings shall be cut with a tool that will provide a neat fit. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles

formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions. Boards of maximum practical length shall be used so that an absolute minimum number of end joints occur. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C 840, System I or GA 216.

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C 840, System II or GA 216.

3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with ASTM C 840, System III or GA 216. This method may be used in lieu of ASTM C 840, System I at the option of the Contractor.

3.2.4 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C 840, System VIII or GA 216.

3.2.5 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C 840, System IX or GA 216.

3.2.6 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than toilet rooms, janitor closets, shower enclosures, wuzus and baptistery), apply glass matt water-resistant gypsum tile backing board in accordance with ASTM C 840, System X or GA 216.

3.2.7 Exterior Application

Apply exterior gypsum board (where indicated at soffits) in accordance with ASTM C 840, System XI or GA 216.

3.2.8 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C 840, System XIII or GA 216, unless indicated otherwise. Control joints between studs in fire-rated construction shall be filled with firesafing insulation to match the fire-rating of construction.

3.2.9 Application of Abuse Resistant Gypsum Board

Apply in accordance with applicable system of ASTM C 840 as specified or GA 216. Follow manufacturers written instructions on how to cut, drill and attach board.

3.2.10 Floating Interior Angles

Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with ASTM C 840, System XII or GA 216, for single-ply and two-ply applications of gypsum board to wood framing.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (toilet rooms, janitor closets, shower enclosures, wuzus and baptistery), apply cementitious backer units behind ceramic tile in accordance with ANSI A108.11. A 7.6 kg asphalt impregnated, continuous felt paper membrane shall be placed behind cementitious backer units, between backer units and studs or base layer of gypsum board. Membrane shall be placed with a minimum 150 mm overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

3.5 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C 840, GA 214 and GA 216.

Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214.

Water resistant gypsum backing board, ASTM C 630/C 630M, to receive ceramic tile shall be finished to Level 2 in accordance with GA 214.

Walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting shall be finished to Level 3 in accordance with GA 214.

Walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings shall be finished to Level 4 in accordance with GA 214.

Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214.

Provide joint, fastener depression, and corner treatment. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

3.5.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint

finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance with GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.6 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07920 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.7 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in UL Fire Resist Dir for the Design Number(s) indicated, or GA 600 for the File Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

3.8 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finish as specified.

3.9 SHAFT WALL FRAMING

The shaft wall systems (if used) shall be installed in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

-- End of Section --

SECTION 09310

CERAMIC TILE, QUARRY TILE, AND PAVER TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1999) Installation of Ceramic Tile; including A108.1A-C, 108.4-.13, 118.1-.10, A136.1
ANSI A108.6	(1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
ANSI A108.7	(1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1999) Test Methods and Specifications for Cementitious Backer Units
ANSI A137.1	(1988) Ceramic Tile

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM C 1026	(1987; R 2002) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1999) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 144	(2003) Aggregate for Masonry Mortar

ASTM C 150	(2002ae1) Portland Cement
ASTM C 206	(2003) Finishing Hydrated Lime
ASTM C 207	(1991; R 1997) Hydrated Lime for Masonry Purposes
ASTM C 33	(2003) Concrete Aggregates
ASTM C 373	(1988; R 1999) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 482	(2002) Bond Strength of Ceramic Tile to Portland Cement
ASTM C 501	(1984; R 2002) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM C 648	(1998)Breaking Strength of Ceramic Tile
ASTM C 847	(1995; R 2000) Metal Lath

BAY AREA (California) AIR QUALITY MANAGEMENT DISTRICT REGULATION

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

SCAQMD Rule #1168	(2003) Adhesive and Sealant Applications

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk	(2003-2004) Handbook for Ceramic Tile Installation

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tile; G
Setting-Bed; G
Mortar, Grout, and Adhesive; G

Manufacturer's catalog data and preprinted installation and cleaning instructions.

Adhesives and Sealants

Manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Material Safety Data Sheets (MSDS) for all primers and adhesives shall be provided to the Contracting Officer. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168. Highlight VOC emissions.

SD-04 Samples

Tile; G
Accessories

Samples of sufficient size to show color range, pattern, type and joints.

SD-06 Test Reports

Testing;

Copy of results for electrical resistance tests.

SD-07 Certificates

Tile; G
Mortar, Grout, and Adhesive; G

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

SD-12 LEED Documentation

Recycled Content; G
Manufacturing Plant Location; G
Regionally Extracted Materials; G
VOC Emissions; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where ceramic tile, quarry tile, and paver tile are

produced, percentage of ceramic tile, quarry tile, and paver tile's raw materials extracted regionally; and VOC emissions for primers and adhesives in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for ceramic tile, quarry tile, and paver tile products.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.7 EXTRA STOCK

Supply an extra two percent of each type tile used in clean and marked cartons.

1.8 PRECONSTRUCTION MEETING

Prior to beginning the installation of any tile surfaces, the contractor, tile installers, other affected trades and government quality assurance staff shall meet to confirm and coordinate the work. Preparation of all areas, including waterproof membranes, to a condition suitable for tile installation shall be confirmed. Materials, detailing and installation methods to be used in all areas of all buildings shall be discussed. Plan for protecting tile following installation shall be confirmed.

1.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of ceramic tile with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Tile installed and coordinated with design layout sketches and adjacent construction.

(4) Verification that joints are installed above all joints in substrate.

(5) Inspection of subfloor to verify proper slope for drainage, completed installation of drains and other permanent construction affecting tile position and pattern coordination.

(6) Finished surfaces meet criteria and design requirements.

(7) Protection of tile surfaces until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg and 113 kg for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C 1028. Glazed floor tile shall be Class IV-Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic. Colors and patterns shall be as indicated on drawings.

2.1.1 Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed porcelain with sharply formed face. Tile size shall be 100 x 100 mm and as otherwise indicated. Provide coved base, bullnosed, top bead, and corner bead shapes as required. Tile shall be unglazed (mat sheen) where used on toilet room and shower floors and walls. Tile used on shower floors shall have a special skid-resistant pattern/texture as indicated on the drawings. Floor tile shall have an abrasive wear greater than 125 in accordance with ASTM C 501. Colors shall be as indicated.

2.1.2 Porcelain Tile

Porcelain tile and trim shall be unglazed with the color extending uniformly through the body of the tile. Nominal tile sizes include 75 x 75, 150 x 150, 300 x 300, 457 x 457, and 150 x 300 as indicated. Review drawings for tile varieties, sizes and patterns. IP equivalent tile sizes are also acceptable. Nominal thickness shall be 9.5 mm (3/8 inch) thick. Tile shall meet or exceed the following criteria: Abrasive wear shall be greater than 125 in accordance with ASTM C 501 and bonding strength in accordance with ASTM C 482. Tile shall comply with 36 CFR 1191 for coefficient of friction for interior floors. Color shall be as indicated.

2.1.3 Glass Tile

Glass tile used in bathrooms shall be 108 mm x 108 mm x 6 mm. Glass tile used at Baptistery shall be 25 mm x 25 mm x 6 mm. Material shall be manufactured for use as wall tile. Material properties shall be appropriate to exposed wall installation. Colors as indicated on drawings. GAT-2 mixture shall consist of the following:

1. Emerald Green 25%
2. Dark Honey 10%
3. Ice White 50%
4. Steel Blue 15%

2.1.4 Accessory Tile

Accessories shall be the built-in type of the same materials and finish as the wall tile. Accessories shall be provided as follows:

Coved bases - use at all vertical to horizontal transitions.

Coved cap - use at curb transition to horizontal surface.

Inside/Outside corner trim - use at all vertical wall inside and outside corner transitions.

Bullnose trim - use at all ceramic tile returning to gypsum or other surface, tops of wainscot.

Soap dish - provide one ceramic tile soap dish with hand hold per shower, color as indicated.

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.2.1 Aggregate for Concrete Fill

Aggregate shall conform to ASTM C 33. Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

2.2.2 Portland Cement

Cement shall conform to ASTM C 150, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Sand shall conform to ASTM C 144.

2.2.4 Hydrated Lime

Hydrated lime shall conform to ASTM C 206, Type S or ASTM C 207, Type S.

2.2.5 Metal Lath

Metal lath shall be flat expanded type conforming to ASTM C 847, and weighing not less than 1.4 kg/square meter.

2.2.6 Reinforcing Wire Fabric

Wire fabric shall conform to ASTM A 185. Wire shall be either 50 x 50 mm mesh, 16/16 wire or 38 x 50 mm mesh, 16/13 wire.

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Dry-Set Portland Cement Mortar

ANSI A108.1.

2.4.2 Conductive Dry-Set Mortar

ANSI A108.1.

2.4.3 Latex-Portland Cement Mortar

ANSI A108.1.

2.4.4 Ceramic Tile Grout

ANSI A108.1; ANSI A118.6; Latex-portland cement grout. Provide unsanded grout. Follow tile manufacturer's written recommendations for mixing, applying and cleaning. Add only water, latex admixture from grout manufacturer, or Laticrete 3701 at the jobsite. Where latex admixture is used in mortar, do not use water. Use only compatible latex additive in grout with proven history of minimizing efflorescence. Color(s) as indicated.

2.4.5 Organic Adhesive

ANSI A108.1, Type I. VOC content of adhesive shall be less than the current VOC limits of SCAQMD Rule #1168.

2.4.6 Glass Tile Mortar

Glass tile mortar shall be recommended for use by the tile manufacturer. Organic adhesive and epoxy are not acceptable. Mortar shall be a white, thin set system suitable for visibility through glass tile.

2.4.7 Glass Tile Grout

Grout shall be a standard sanded grout intended for use with ceramic tile.

2.4.8 Cementitious Backer Board

Cementitious backer units, for use as title substrate over steel stud walls, shall be in accordance with ANSI A118.9 and consistent with SECTION 09250 GYPSUM WALLBOARD. Cementitious backer units shall match the thickness of adjacent Gypsum Wallboard. Where only cementitious backer units are present on a wall, minimum thickness shall be 16 mm.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1 for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Organic Adhesives	3 mm in 2.4 meters	1.5 mm in 1 meters
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed over cementitious backer board in accordance with the TCA Hdbk, method W244 at wet and dry wall locations and in conjunction with B415 at shower areas. Wall areas adjacent to shower stalls shall have a membrane meeting ANSI A108.10 installed per W244.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set or Latex-portland cement shall be used to install wall tile in accordance with ANSI A108.1. Latex-portland cement shall be used when installing porcelain ceramic tile. Latex-portland cement shall be used in shower stalls and shower rooms.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk, methods F112 or F113 at slab on grade as indicated on drawings. Coordinate slab on grade depression areas and internal slope to drain. Shower receptors shall be installed in accordance with TCA Hdbk, method B415.

3.4.1 Workable or Cured Mortar Bed

Floor tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. Workable mortar bed materials and installation shall conform to ANSI A108.1. Cured mortar bed and materials shall conform to ANSI A108.1. Joints between quarry tile shall be between 6.35 mm (1/4 inch) and 9.53 mm (3/8 inch) in width and shall be uniform in width.

3.4.2 Dry-Set and Latex-Portland Cement

Dry-set or Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.1. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.3 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.6 or ANSI A108.7.

3.4.4 Waterproofing

Shower pans are specified in Section 15400 PLUMBING, GENERAL PURPOSE. Waterproofing under concrete fill, mortar bed or thin set installations shall conform to the requirements of Section 07131 ELASTOMERIC SHEET WATERPROOFING.

3.4.5 Concrete Fill

Concrete fill shall be composed by volume of 1 part portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mixed with water to as dry a consistency as practicable. The fill shall be spread, tamped, and screeded to a true plane, and pitched to drains or leveled as shown. Concrete fill shall be thoroughly damp cured before application of setting-bed material. Concrete fill shall be reinforced with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped not less than 50 mm. Laps shall be tied together with 1.3 mm (18 gauge) wire every 250 mm along the finished edges and every 150 mm along the cut ends and edges. The reinforcement shall be

supported and secured in the centers of concrete fills. The mesh shall be continuous; except where expansion joints occur, mesh shall be cut and discontinued across such joints. Reinforced concrete fill shall be provided under the setting-bed where the distance between the under-floor surface and the finished tile floor surface is 50 mm or greater, and shall be of such thickness that the mortar setting-bed over the concrete fill shall be not less nor more than the thickness required in the specified TCA Hdbk methods.

3.5 INSTALLATION OF CONDUCTIVE FLOORING

Conductive ceramic mosaic tile floors shall be installed in accordance with ANSI A108.1.

3.6 EXPANSION JOINTS

Joints shall be formed as indicated, recommended by TCA Hdbk and sealed as specified in Section 07920 JOINT SEALANTS.

3.6.1 Walls

Expansion joints in tile shall be provided where expansion joints occur in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.6.2 Floors

Expansion joints shall be provided over expansion joints in concrete slabs. Expansion joints shall extend through setting-beds and fill. Sealant material and size shall be appropriate for the adjacent tile material and exposure to foot traffic and moisture.

3.7 CONSTRUCTION/COLD JOINTS

Construction and cold joints shall be avoided in structural slabs at tile floors. Where they occur, provide a full depth joint in tile system complete with backer rod and sealant.

3.8 MOVEMENT AND PERIMETER JOINTS

Movement joints shall be provided where tile abuts restraining surfaces and changes in material. Typical locations are perimeter walls, curbs and columns and at intervals of 7200 to 10800 mm each way in large interior floor areas and 3600 to 4800 mm each way in large exterior areas or areas exposed to direct sunlight or moisture. Movement joints shall utilize bond breaker tape and sealant appropriate for the adjacent tile material and exposure to foot traffic and moisture.

3.9 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout

manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a non-corrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

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SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 366/A 366M	(1997e1) Commercial Steel, Sheet, Carbon,(0.15 Maximum Percent Cold-Rolled**
ASTM A 641/A 641M	(1998) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 423	(2002a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(2003) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C 834	(2000e1) Latex Sealants
ASTM E 1264	(1998) Acoustical Ceiling Products
ASTM E 1414	(2000a) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a; R 2003) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E 580	(2002) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In

	Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2000) Mounting Test Specimens During Sound Absorption Tests

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-03 Product Data

Acoustical Ceiling Systems; G

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

SD-04 Samples

Acoustical Units; G

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

SD-06 Test Reports

Ceiling Attenuation Class and Test; G

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements.

SD-07 Certificates

Acoustical Units; G

Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where acoustical ceiling tile was produced, and percentage of acoustical ceiling tile's raw materials extracted regionally in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to search for regional suppliers for acoustical ceiling tile products.

1.4 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified and indicated on drawings. Suspended ceiling grids have been drawn using a 610 x 610 (nominal 24 x 24 inch) grid. The Contractor has the option to use Recessed Light Fixtures (RLF) manufactured to meet inch-pound (I-P) or metric modules. Regardless of the measurement module selected, the Contractor shall furnish all ceiling elements, including RLF, acoustical ceiling tiles, air diffusers, air registers and grills, and similar items in the same system of measurement. The Contractor shall coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor shall be responsible for all associated labor and materials and for the final assembly and performance of the specified work and products regardless of the measurement system selected. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

1.4.1 Ceiling Attenuation Class and Test

The ceiling attenuation class (CAC) of the ceiling system shall be 35 minimum when determined in accordance with ASTM E 1414. Provide fixture

attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.4.2 Ceiling Sound Absorption

Determine the NRC in accordance with ASTM C 423 Method of Test.

1.4.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.6 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C nor more than 29 degrees C and a relative humidity of not more than 70 percent shall be maintained for 24 hours before, during, and 24 hours after installation of acoustical units.

1.7 SCHEDULING

Interior finish work such as plastering and concrete work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.8 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.9 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Tiles shall be from the same lot as those installed.

1.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of Acoustical Ceilings with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Acoustic ceiling panels meet specified sound absorption and transmission criteria.

(4) Shop drawings include explicit identification of coordination with other trades.

(5) Installation is coordinated with interfacing construction to eliminate conflicts.

(6) All damaged tiles are replaced and soiled tiles are cleaned or replaced.

(7) Finished surface of ceiling provides a level, consistent plane over the entire face.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Units shall be manufactured with minimum 50% recycled content. Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System (ACT-1) - Typical Offices and Classrooms

Type: III (non-asbestos mineral fiber with painted finish), Form 1.

Minimum NRC: 0.75 in all rooms and areas when tested on mounting Type E-400 of ASTM E 795.

Pattern/Texture: E I C / Fine.

Nominal size: 610 by 610 by 22 mm.

Edge detail: Beveled tegular.

Finish: Factory-applied standard finish, white latex paint.

Minimum LR coefficient: 0.85 or greater.

Minimum CAC: 35.

Flame Spread: Class A, 25 or less, UL labeled.

Anti-Microbial Protection: Yes

Reference Product: Armstrong, Cirrus Open Plan

2.1.2 Units for Exposed-Grid System (ACT-2) - Classroom 143 (Nursery) and Classroom 149C (Blessed Sacrament)

Type: III (non-asbestos mineral fiber with painted finish), Form 1.

Minimum NRC: 0.60 in all rooms and areas when tested on mounting Type E-400 of ASTM E 795.

Pattern/Texture: E K /Fine.

Nominal size: 610 by 610 by 19 mm.

Edge detail: Tier Reveal

Finish: Factory-applied standard finish, white latex paint.

Minimum LR coefficient: 0.80 or greater.

Minimum CAC: 35.

Flame Spread: Class A, 25 or less, UL labeled.

Anti-Microbial Protection: Yes

Reference Product: Celotex, Cashmere, Integrated Accents

2.2 SUSPENSION SYSTEM

Suspension system shall be standard exposed-grid, narrow width (14 mm) flange. System shall conform to ASTM C 635 for heavy-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied baked-enamel finish matching color of tiles. Wall molding shall meet code required minimum support length and shall have a flange of not less than 12 mm at narrow width grid. Inside and outside corner caps and inside and outside shadow mold corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic details shall conform to the guidance in TI 809-04 and ASTM E 580 and shall meet requirements for seismic zone 3 and seismic design category D.

2.3 HANGERS

Hangers and attachment shall support a minimum 1330 N ultimate vertical load without failure of supporting material or attachment. Provide 6 mm diameter galvanized steel eye bolts with lag screw threads as attachment points to wood structural members, minimum load capacity of 2200 N (500 pounds). Shank of eye bolt shall be long enough to allow for a minimum of 25 mm of threaded penetration. Do not anchor hangers directly to SIP roof system. Hangers shall be connected to continuous wood nailers or light gauge steel channel member anchored to SIP.

2.3.1 Wires

Wires shall conform to ASTM A 641/A 641M, Class 1, 2.7 mm in diameter. Where span between wires is greater than 1200 mm, use 4 mm diameter wire.

2.3.2 Straps

Straps shall be 25 by 5 mm galvanized steel conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 366/A 366M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

2.3.3 Rods

Rods shall be 5 mm diameter threaded steel rods, zinc or cadmium coated.

2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Access panels shall match standard tile size in field of ceiling. At ceiling perimeter, panels shall be not less than 300 by 300 mm or more than 300 by 600 mm.

a. An identification plate of 0.8 mm thick aluminum, 19 mm in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.

b. Identify building system reached by ceiling access panel with a number utilizing white identification plates or plastic buttons with contrasting numerals. The plates or buttons shall be of minimum 25 mm diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system shall be as follows:

1 Fire detection/alarm system

2 Ventilation system controls

3 Plumbing system

4 Heating system

5 Ventilation system ducts

6 Sprinkler system

7 Intercommunication system

8 Not used

9 Not used

10 Not used

11 Cable and Closed Circuit Television system

12 Telephone junction boxes

2.5 ADHESIVE

Adhesive shall be as recommended by tile manufacturer.

2.6 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.7 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be white unless noted otherwise on drawings.

2.8 ACOUSTICAL SEALANT

Acoustical sealant shall conform to ASTM C 834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Areas where acoustical units will be cemented shall be free of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Interior finish work such as plastering and concrete, shall be completed and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation. Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for

each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking, or from mechanical or electrical equipment, or any other object that is itself suspended. All light fixtures, air terminal devices and like components integrated into the ceiling system shall be suspended independently of the ceiling suspension system. Provide 4 suspension wires for each item. Attach fixtures to ceiling grid system.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 150 mm from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means. Splayed hangers shall also be incorporated to resist seismic loads. Installation shall be as indicated in ASTM C 636. Splay wires shall be provided at all vertical offsets in ceiling plane.

3.1.1.3 Compression Struts

Provide compression struts fabricated of light gauge metal at all locations were splay bracing is installed. Struts shall be rigidly attached to main runners and structure.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units

shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per square m or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings. See Section 07920 JOINT SEALANTS.

3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.4 RECLAMATION PROCEDURES

Ceiling tile that has been damaged shall be recycled. Neatly stack tiles on 1220 by 1220 mm pallets not higher than 1220 mm. Panels shall be completely dry. Pallets shall then be shrink wrapped. Disposal shall be in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

-- End of Section --

SECTION 09580

OPEN GRID METAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 366/A 366M	(1997e1) Commercial Steel, Sheet, Carbon,(0.15 Maximum Percent Cold-Rolled**
ASTM A 641/A 641M	(1998) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(2003) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 580	(2002) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(2004) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-03 Product Data

Open Grid Metal Ceiling Systems

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

SD-04 Samples

Grid and Panel Cells

Samples of suspension grid tee section with web covers and panel cell inserts showing finish and color.

SD-06 Test Reports

Fire Resistive Ceilings

Reports by an independent testing laboratory attesting that ceiling systems meet specified fire endurance requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resist Dir may be submitted in lieu of test reports.

SD-07 Certificates

Grid and Panel Cells

Certificate attesting that the materials furnished for the project contain recycled material and showing an estimated percent of such material.

1.3 GENERAL REQUIREMENTS

Unit size, texture, finish, and color shall be as indicated on drawings. Layouts on drawings shown with a nominal 610 x 610 mm grid consistent with 24 x 24 inch IP grid. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like ceiling

grids, air diffusers, air registers and grills, shall also be I-P products. The Contractor shall coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. If I-P products are used, the Contractor shall be responsible for all associated labor and materials and for the final assembly and performance of the specified work and products.

1.3.1 Fire Resistive Ceilings

Ceiling system shall be a Class A material and have a flame spread of 0 and smoke development shall be 0 when tested in accordance with ASTM E 84.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures.

1.5 ENVIRONMENTAL REQUIREMENTS

Building shall be weathertight and both temperature and humidity shall be constantly maintained in the normal occupied range prior to installation of the ceiling system.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and painting shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace ceiling materials that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panel cells; rusting and manufacturer's defects of grid system.

PART 2 PRODUCTS

2.1 Open Grid Lay-in Panels

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.1.1 Material

Panels shall utilize 0.61 mm (0.024 inch) thick formed aluminum members. Material shall be factory finished with a baked-on polyester enamel coating.

2.1.2 Configuration

Lay in panels shall be nominal 610 x 610 mm (24 x 24 inches). Panel shall form a subdivided grid with 100 mm x 100 mm (4 x 4 inch) spacing. All blades composing the grid shall be the same width 14 mm (9/16 inch) and height 50 mm (2 inches).

2.2 SUSPENSION SYSTEM

Suspension system shall be exposed-grid, direct hung, from subframe structure with 14 mm (9/16 inch) width flange, and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum with a factory-applied color baked-enamel finish. Wall molding shall have a flange of not less than 25 mm (1 inch). Standard corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic details shall conform to the guidance in TI 809-04 and ASTM E 580 and as shown on the drawings.

2.2.1 Main Runners

Main runners shall be "Tee" shaped, manufactured from not less than 0.5 mm (0.018 inch) thick steel. Sizes shall be 14 mm (9/16 inch) wide by 38 mm (1-1/2 inch) tall and be one piece. Runners shall have factory fabricated cross tee slots, hanger holes, end couplings and similar fittings necessary for a structurally integrated system. Color and finish to match lay-in panels.

2.2.2 Cross Tees

Cross tees shall be manufactured from not less than 0.5 mm (0.018 inch thick) steel. Sizes shall be 14 mm (9/16 inch) wide by 38 mm (1-1/2 inch) tall by 610 mm (24 inches) long. Runners shall have factory fabricated cross tee slots, hanger holes, end couplings and similar fittings necessary for a structurally integrated system. Color and finish to match lay-in panels.

2.2.3 Web Covers

Covers shall be manufactured from not less than 0.3 mm (0.012 inch) thick steel. Sizes shall be formed in a "U" shape, 8 mm (5/16 inch) wide by 50 mm (2 inches) tall and be one piece. Coordinate hanger holes and similar fittings as necessary for the suspension system to be used. Color and finish to match lay-in panels.

2.2.4 Perimeter

Wall angles, manufactured from not less than 0.5 mm (0.020 inch) thick steel. Sizes shall be 25 mm (1 inch) wide by 50 mm (2 inches) tall and be one piece. Exposed surfaces shall have color and finish to match lay-in panels.

2.3 HANGERS

Hangers and attachment shall support a minimum 1330 N ultimate vertical load without failure of supporting material or attachment. All wire, straps, rods, structural subframing and other materials positioned above the plane of the ceiling shall be painted flat black prior to ceiling grid installation.

2.3.1 Wires

Wires shall conform to ASTM A 641/A 641M, Class 1, 2.7 mm in diameter.

2.3.2 Straps

Straps shall be 25 by 5 mm galvanized steel conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 366/A 366M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

2.3.3 Rods

Rods shall be 5 mm diameter threaded steel rods, zinc or cadmium coated.

2.4 FINISHES

Components shall have manufacturer's standard finishes with custom colors as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.5 COLORS AND PATTERNS

Colors and patterns for open grid system and suspension system components shall be as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

Examine surfaces to receive suspended open grid ceiling for unevenness, irregularities, square layout of GWB surrounds and dampness that would affect quality and execution of the work. Interior finish work such as plastering, concrete and painting shall be completed and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of ceiling installation.

3.2 INSTALLATION

Ceiling shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing ducts, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a sub-suspension system shall be installed, so that all hanger wires will

be plumb.

3.2.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein.

3.2.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 150 mm from each corner of each fixture. See Section 16415 ELECTRICAL WORK,INTERIOR for additional lighting installation requirements.

3.2.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.2.2 Main Runners

Install with minimum 12 gauge hanger wire, tied with 3 full turns at not more than 1220 mm on center.

3.2.3 Wall Angles

Wall angles shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.4 CLEANING, REPAIR AND REPLACEMENT

Clean all ceiling and adjacent surfaces soiled during installation with a non-solvent based non-abrasive solution. Adjust and repair grid system not completely attached or aligned. Remove all damaged components and replace with new, undamaged components matching color and finish.

-- End of Section --

SECTION 09640

WOOD STRIP FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA GS	(1999) Guide Specifications for Maple Flooring Systems

1.2 SYSTEM DESCRIPTION

Installation of hardwood strip floorings on wood subfloor.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Platforms and risers G;

Expansion joint details.

SD-03 Product Data

Installation

Manufacturer's descriptive data and installation instructions.

SD-04 Samples

Strip Flooring

Two samples of each type of strip flooring with finish system.

SD-07 Certificates

Flooring Materials G;

Statement from the manufacturer attesting that the materials meet the specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements being certified.

SD-08 Manufacturer's Instructions

Adhesive
Finish
Polyurethane coating
Wax Finish

Include manufacturer's material safety data sheets for adhesives, finishes, and other materials which may be considered hazardous because of toxicity, flammability, or reactivity.

SD-10 Operation and Maintenance Data

Flooring Materials; G

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Flooring shall be stored in fully covered, well ventilated areas and protected from extreme changes in temperature and humidity. Flooring shall be maintained at an average moisture content of 6 to 9 percent. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed. Store the flooring in the building or space where the flooring is to be laid for a minimum of 5 days to allow absorbed moisture to evaporate. Separate the wood parquet so that all pieces are exposed to the air during this 5-day period to allow uniform acclimation.

1.5 ENVIRONMENTAL CONDITIONS

Rooms where wood flooring is to be installed shall have permanent heating and air conditioning installed and working or adequate arrangements for ventilation and temperature controls. The temperature shall be maintained at 14 to 27 degrees C and the humidity shall be maintained as recommended by the manufacturer starting not less than 5 days prior to beginning the installation of flooring and continuing throughout the remainder of the contract period.

1.6 SCHEDULING

Strip flooring work shall be scheduled after any other work which would raise the moisture content of the building or the flooring or damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2 PRODUCTS

2.1 STRIP FLOORING

Strip flooring shall be 20 mm thick by 57 mm face width, kiln dried, continuous tongue and groove and of standard lengths. Flooring shall be cut with square edges and ends. Hard maple shall be "select and better" grade in accordance with MFMA GS. Strip flooring shall be marked with the trademark of the grading agency.

2.2 NAILS

Nails shall be in accordance with strip flooring manufacturer's recommendations.

2.3 ASPHALT FELT

Asphalt felt or building paper, 15# grade.

2.4 WALL BASE

Wall base shall be wood molding or vented cove as indicated with mitered inside and outside corners.

2.5 ADHESIVE

Waterproof and suitable for use with underlayment used, and as recommended by the flooring manufacturer.

2.6 SUBFLOOR

Subfloor shall be 25 or 28 mm tongue and groove, sheathing grade, exterior plywood as specified in Section 06100 Rough Carpentry.

2.7 RISERS, TREADS AND EDGES

Risers, treads and platform edges incorporated with platform surfaces and choir risers shall be the same wood species and selected for color blend. Sizes as indicated on drawings.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Platform surface shall be clean, dry, and approved prior to start of installation. Verify that all subfloor is secure. Re-nail any areas that exhibit movement. Verify that all floor mounted electrical and telecommunications items are in place and secured.

3.2 INSTALLATION

3.2.1 Preparation

Do not begin flooring installation until all wet work in the building has cured for at least 14 days and all building openings are permanently enclosed. Sweep or vacuum subfloor clean. Mark location of supporting joists on adjacent walls to facilitate nailing to joists. Cover platform with 15 lb asphalt felt with 100 mm edge laps. Mark joist locations with string line.

3.2.2 Layout

Strip flooring shall be laid out to provide an overall light appearance; contrast from one board to the next shall be gradual in order to avoid dark streaks.

3.2.3 Installation

Flooring shall be installed in accordance with the approved installation instructions of the manufacturer. Unless otherwise approved, flooring shall be laid parallel to the length of the area to be floored and perpendicular to joists. Strips shall be laid with close joints, snugly driven up but providing for absorption of a small amount of expansion consistent with humidity conditions expected during the life of the flooring. End joints shall be so alternated that there will be at least two boards between end joints in the same plane and at least 150 mm between end joints in adjacent boards.

3.2.4 Expansion

Space for expansion shall be left along perimeter walls and around fixed projections through the floor surface. Expansion space shall be of the size recommended by the flooring manufacturer and NOFMA. Unless otherwise shown or permitted by the approved installation instructions, expansion space shall be not less than 5 mm per meter of distance between opposite walls, with one half the space provided at each wall and with a minimum space of 13 mm at each wall.

3.2.5 Pattern

Adjust pattern layout to provide for even distribution of long and short pieces. Do not group short boards. Do not group pieces with darker color or grain structure.

3.2.6 Openings

Provide a frame with strip flooring around openings. Frame corners shall be mitered.

3.2.7 Nailing

Follow NOFMA nailing schedule for blind nailing of combined flooring and subfloor thickness. Fasten each piece with a minimum of two nails from 25 - 75 mm from the ends. Install additional nails such that the maximum nail

spacing on any piece is not greater than 250 mm. Where treads and edges join strip flooring provide a slip tongue or similar connection between pieces to prevent differential movement.

3.2.8 Adhesive Applied

Use adhesive only for conditions were satisfactory nail attachment is not possible. Prepare substrate in accordance with the printed instructions of the flooring manufacturer.

3.3 SANDING

Flooring shall be sanded to a smooth, even, level and uniform finish without burns. A minimum of three sanding cuts, each with a finer sandpaper, shall be made. A heavy drum-type sander shall be used for floors, except a disc-type sander will be permitted for the final cut on strip flooring. Either the first pass or the second pass of the drum-type sander shall be at an angle of 45 degrees to the grain; other passes of the drum-type sander shall be in the direction of the grain of strip flooring. Edges not reached by the sander shall be finished with an edger or by hand methods. The final sanding shall be performed at a time and in a manner that will permit application of the first seal coat as specified in Section 09900 PAINTS AND COATINGS to be completed within 8 hours after completion of sanding. After final sanding and buffing, vacuum or tack floors in accordance with finish manufacturer's recommendations. Wipe off foot marks. The flooring shall be left clean and ready to receive the finishing materials.

3.4 FINISH

After final sanding and buffing have been completed, stain "Golden Oak" to match adjacent wood colors and apply two coats of finish; use low gloss, satin finish polyurethane coating recommended by flooring manufacturer for type and specie of wood flooring specified.

When floors are dry, apply two coats of wax, unless otherwise recommended in writing by manufacturer of flooring. Spread at rate of 0.07 L/10 square meters . Within 15 to 30 minutes after wax application, polish floors with weighted floor brush or electric polisher.

3.5 PROTECTION

From the time of installation until final acceptance, flooring shall be protected from damage.

-- End of Section --

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SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2240	(2003) Rubber Property - Durometer Hardness
ASTM D 3389	(1999) Test Method for Coated Fabric Abrasion Resistance
ASTM D 4078	(2002) Standard Specification for Water Emulsion Floor Polish
ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F 710	(2003) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
ASTM F 1344	(2004) Rubber Floor Tile
ASTM F 1482	(2004) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
ASTM F 1861	(2002) Resilient Wall Base
ASTM F 1869	(2003) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F 2169	(2002) Resilient Stair Treads
ASTM F 2170	(2002) Determining Relative Humidity in Concrete Floor Slabs in situ Probes

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

BAAQMD Regulation 8, Rule 51	(2003) Bay Area Air Quality Management District, Regulation 8, Organic Compounds

Rule 51 Adhesive and Sealant Products

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule #1168 (2003) Adhesive and Sealant Applications

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories; G,

Scaled drawings indicating patterns (including location of patterns and colors) and dimensions.

SD-03 Product Data

Resilient Flooring and Accessories; G,

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

Adhesives and Sealants

Manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Material Safety Data Sheets (MSDS) for all primers, adhesives, and sealants shall be provided to the Contracting Officer. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168. Sealants used as fillers must meet or exceed the requirements of the BAAQMD Regulation 8, Rule 51. Highlight VOC emissions.

SD-04 Samples

Resilient Flooring and Accessories; G,

Three samples of each indicated color and type of flooring, base, moldings, and accessories. Sample size shall be minimum 60 x 100 mm .

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests; G,

Test reports of moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

SD-08 Manufacturer's Instructions

Surface Preparation
Installation

Manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, recommended adhesives, and recommended sealants.

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories; G,

Data in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

SD-12 LEED Documentation

Recycled Content; G,
Rapidly Renewable Materials; G,
Manufacturing Plant Location; G,
Regionally Extracted Materials; G
VOC Emissions; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, percentage of materials made from rapidly renewable resources, the location of the manufacturing plant where resilient flooring was produced; the percentage of resilient flooring's raw materials extracted regionally, and VOC emissions for primers, adhesives, and sealants in accordance with LEED-NC RG.

SD-14 Warranties

Warranty; G,

Manufacturer's warranty for flooring.

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for resilient flooring products.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 21 degrees C for three days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Do not open containers until materials are to be used, except for verification inspection. Observe ventilation and safety procedures specified in the MSDS.

1.6 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C and below 38 degrees C for 2 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. A minimum temperature of 13 degrees C shall be maintained thereafter. Observe ventilation and safety procedures specified in the MSDS. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.7 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.8 WARRANTY

Cork tile flooring shall have a minimum 5 year warranty to be free from manufacturer's defects. Rubber sheet and tile flooring shall have a minimum one year warranty to be free from manufacturer's defects and a ten year warranty against wear. Rubber stair tread, riser, and stringer covering shall have a minimum one year warranty to be free from manufacturer's defects and a five year warranty against wear. Linoleum sheet and tile flooring shall have a minimum five year warranty to be free from manufacturer's defects and a five year warranty against wear. Vinyl sheet and vinyl composition tile flooring shall have a minimum one year warranty to be free from manufacturer's defects and a five year warranty against wear.

1.9 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Extra wall base material

composed of 6 meters of each type, color and pattern shall be furnished. All extra materials shall be packaged in original properly marked containers bearing the manufacturer's name, brand name, pattern color name and number, production run, and handling instructions. Extra materials shall be from the same lot as those installed. Leave extra stock at site in location as directed by Contracting Officer.

PART 2 PRODUCTS

2.1 RUBBER TILE

Rubber tile shall conform to ASTM F 1344. Rubber tile shall be colored with fade resistant pigments throughout the tile and have a speckled or mosaic pattern. A monolithic color and/or pattern is not acceptable. Rubber tile shall conform to ASTM D 3389 less than .7 grams. Rubber tile shall conform to ASTM D 2240 and be a minimum 500 mm square. Surface shall be smooth with chamfered edges. Overall thickness shall be a minimum 3.5 mm.

Manufacturers: Expanko, Reztec Rubber Flooring
Endura Rubber Flooring
Activa Rubber Flooring
Nora Rubber
Johnsonite
Flexco

2.2 WALL BASE

Base shall conform to ASTM F 1861, thermoplastic rubber, straight style - installed with carpet and coved style - installed with resilient flooring. Base shall be 100 mm high and a minimum 3.0 mm thick. Preformed corners in matching height, shape, and color shall be furnished. Colors as indicated.

2.3 INTEGRAL COVE BASE

Integral coved base for rubber tile flooring shall extend up the wall 100 mm. A rubber cap strip and rubber fillet strip with a minimum radius of 19 mm shall be provided for integral coved bases at perimeter and fixed vertical interruptions to flooring. Integral cove shall be of the same material as flooring. Provide inside and outside corner protectors of indicated colors as approved by flooring manufacturer.

2.4 STAIR TREADS, RISERS, AND STRINGERS

Treads, risers, and stringers shall conform to ASTM F 2169 thermoplastic rubber. Surface of treads shall conform to ASTM F 2169 Class 2 raised round, square, or diamond pattern. Nosing shall be round. Design shall be either a one piece nosing/tread/riser or a two piece nosing/tread with a matching coved riser.

2.5 FEATURE STRIP

Feature strips shall be rubber tile and conform to ASTM F 1344 Class 1, and be 25 mm wide, and of thickness to match the flooring. Color shall be as indicated. Provide in contrasting color to mark edges of stairs, landings

and similar transitions.

2.6 MOULDING

Provide tapered mouldings of rubber and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Vertical lip on moulding shall not be greater than 6 mm. Change in level between 6 and 13 mm shall be beveled with a slope no greater than 1:2.

2.7 ADHESIVES AND SEALANTS

Adhesives for flooring, base and accessories shall be as recommended by the manufacturer and comply with local indoor air quality standards. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168.

2.8 SURFACE PREPARATION MATERIALS

Surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers shall be as recommended by the flooring manufacturer for the subfloor conditions. Panel type underlayment products shall comply with ASTM F 1482.

2.9 POLISH/FINISH

Polish shall be as recommended by the manufacturer and conform to ASTM D 4078.

2.10 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07920 JOINT SEALANTS. VOC content for sealants must be less than the current VOC content limits of SCAQMD Rule #1168

2.11 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Color, pattern and texture for resilient flooring and accessories shall be as indicated on the drawings. Flooring in any one continuous area shall be from same production run with same shade and pattern.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Contracting Officer. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Floor shall be flat to within 5 in 3000 mm. Subfloor shall be prepared in accordance with flooring manufacturers recommended instructions. The surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) shall be prepared as recommended by the flooring manufacturer. Concrete subfloor preparation shall comply with ASTM F 710. Floor fills or toppings may be required as recommended by the flooring manufacturer. Underlayments when required by the flooring manufacturer shall be installed in accordance with manufacturer's recommended installation instructions. Panel type underlayments shall comply with ASTM F 1482. Before any work under this section is begun, all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing and sealer compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level shall be determined by moisture and alkalinity tests and shall comply with manufacturers recommendations. Moisture testing shall be in accordance with ASTM F 1869 or ASTM F 2170 unless otherwise recommended by the flooring manufacturer. Moisture test shall be performed by an independent testing laboratory with at least 3 years experience in moisture testing of materials. Moisture tests shall be performed in multiple floor areas. Moisture tests shall be repeated as necessary until a passing test is obtained. Alkalinity testing shall be as recommended by the flooring manufacturer. The compatibility of the resilient flooring adhesives to the concrete floors shall be determined by a bond test in accordance with the flooring manufacturers recommendations.

3.4 PLACING RUBBER TILE

Rubber tile and accessories shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Flooring lines and joints shall be square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary width of edge tiles as necessary to maintain full-size tiles in field, but no edge tile shall be less than one-half full size, except where irregular-shaped rooms makes it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Flooring shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

3.5 PLACING FEATURE STRIPS

Feature strips shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions.

3.6 PLACING MOULDING

Provide moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Moulding shall be secured with adhesive as recommended by the manufacturer. Adhesives shall be prepared and applied in accordance with manufacturers directions.

3.7 PLACING WALL BASE

Wall base shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk. Holes, gaps, and seams in gypsum wallboard larger than 25mm in width shall be filled and sanded flush with surface. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Inspect preformed corners for color match with running base. Do not install corners that are not color matched. Avoid excess adhesive in corners. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.8 PLACING STAIR TREADS, RISERS, AND STRINGERS

Stair treads, risers, and stringers shall be securely attached and installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Treads and risers shall cover the full width of the stairs. Stairs wider than manufacturer's standard lengths shall have equal length pieces butted together to cover the treads. Where indicated on the room finish schedule, installation shall include stringer angles on both the wall and banister sides, and landing trim.

3.9 PLACING INTEGRAL COVED BASE

Integral cove base shall be installed in accordance with manufacturer's installation instructions. Adhesives shall be prepared and applied in accordance with manufacturers directions. Integral coved base shall be formed by extending the flooring material 100 mm onto the wall surface. Cove shall be supported by a filler. A cap strip shall be provided at the top of the base. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.10 CLEANING

Immediately upon completion of installation of flooring in a room or an area, flooring and adjacent surfaces shall be dry-cleaned to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and, except for rubber

flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish by manufacturer, given the number of coats of polish in accordance with manufacturer's written instructions. All other flooring shall be cleaned and maintained as recommended by the manufacturer.

3.11 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered shall be removed and replaced.

-- End of Section --

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SECTION 09685

CARPET TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1998) Test Method: Colorfastness to Light
AATCC 134	(2001) Test Method: Electrostatic Propensity of Carpets
AATCC 165	(1999) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method
AATCC 174	(1998) Antimicrobial Activity Assessment of Carpet

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 418	(1993; R 1997) Pile Yarn Floor Covering Construction
ASTM D 3278	(1996e1) Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 5252	(2001) Practice for the Operation of the Hexapod Tumble Drum Tester
ASTM D 5417	(1999) Practice for Operation of the Vettermann Drum Tester
ASTM D 5793	(1995) Standard Test Method for Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D 5848	(1999) Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Commercial Carpet Installation Standard
CRI Green Label	(2003) Green Label for Indoor Air Quality Test Program

FEDERAL STANDARDS

FED-STD-501	(1966) (Method 6511) Flexibility, Low Temperature

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630	Standard for the Surface Flammability of Carpet and Rugs (FF 1-70)
40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551	(1981) Machine-made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effect of Varied Water and Heat Conditions (AACHEN Test)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The abbreviation "DO" signifies the COE District Office. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G
Molding; G

Drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding. Provide a tabulation of the total area of each carpet type, pattern and color to be installed.

SD-03 Product Data

Carpet; G,

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

Surface Preparation; G,
Installation; G,

Manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques (if any), and recommended adhesives and tapes.

Adhesives

Manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Material Safety Data Sheets (MSDS) for all primers and adhesives shall be provided to the Contracting Officer. VOC limits must meet or exceed the requirements of the CRI Green Label Criteria. Highlight VOC emissions.

SD-04 Samples

Carpet; G,
Molding; G,

a. Carpet: Two "Production Quality" samples 450 x 450 mm of each carpet proposed for use, showing quality, pattern, and color specified/proposed.

b. Carpet: Two copies of manufacturer's standard pattern/color sample folder showing all options within the product/pattern line(s) intended for use.

c. Rubber Moldings: Two pieces at least 300 mm long. Provide actual material color samples of manufacturer's entire standard color group for selection by C.O.R.

d. Special Treatment Materials: Two samples showing system and installation method(s).

SD-06 Test Reports

Moisture and Alkalinity Tests; G,

Test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

Flammability; G

Static control; G

Carpet and Rug Institute (CRI) Green Label Requirements for Indoor

Air Quality Test Criteria; G

In addition to test reports, provide CRI certification number.

SD-07 Certificates

Carpet Tile; G,

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet tile conforms to the standards specified.

Installation Experience; G

Certification from the carpet installation firm that the firm and installers have a minimum of five years experience installing carpet tile.

Installation Firm and Installer Approval; G

Written statement from the carpet manufacturer that the installation firm and installers are approved for the carpet type(s) to be installed.

Regulatory Requirements; G,

Manufacturer's certification stating that the carpet contains recycled materials, indicating the type(s) and actual percentages of recycled material(s) and identifying the percentages of "post-consumer" and "post-industrial" content.

SD-08 Manufacturer's Instructions

Carpet Tile Installation; G

Submit the carpet manufacturer's printed installation instructions. Include procedures for installation covering preparation of the substrate, substrate sealer application (if necessary), seaming techniques (if any), and recommended adhesives and tapes where applicable.

SD-10 Operation and Maintenance Data

Carpet; G,
Cleaning and Protection; G

Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G
Regionally Extracted Materials; G
VOC Emissions; G
Manufacturer's Sustainable Practices; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, location of the manufacturing plant where carpet tile is produced, percentage of carpet's materials extracted regionally; and VOC emissions for primers and adhesives in accordance with LEED-NC RG.

Document carpet manufacturer's program for recycling, refurbishing, reusing or repurposing carpet materials. Document manufacturer's program for environmentally sustainable manufacturing.

1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the CRI Green Label or demonstrate compliance with CRI testing criteria and frequencies through independent laboratory test results. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI Green Label, and minimizes the impact on indoor air quality. Contractor shall procure carpet in accordance with 40 CFR 247. Carpet shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in an enclosed, clean, dry, well ventilated area, protected from damage and soiling, and shall be maintained at a temperature above 16 degrees Cfor 2 days prior to installation.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 13 degrees C shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.6 INSTALLATION REQUIREMENTS

1.6.1 Experience

All work shall be done by an installation firm specializing in commercial carpet installation. Firm shall have a minimum of five years experience in commercial carpet installation. Installation firm and installers shall be approved by the carpet manufacturer.

1.6.2 Certificate

Submit certificate from the installation firm attesting that the installation supervisor has had a minimum of 5 years experience in this type of work and will provide qualified, experienced installers to perform work. Include a list of previous jobs giving name, location, dollar value, and date, setting forth supervisor's installation experience.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties including minimum fifteen (15) year surface wear warranty, two (2) year material and workmanship and fifteen (15) year tuft bind and delamination. Provide manufacturer's standard antistatic guarantee. Performance warranties shall be the responsibility of only the manufacturer. Warranties shall not be prorated.

1.8 EXTRA MATERIAL

Extra material from same dye lot consisting of uncut carpet tiles shall be provided for future maintenance. A minimum of 3 percent of total square meters installed of each carpet type, pattern, and color shall be provided.

1.9 SUSTAINABLE DESIGN REQUIREMENTS

All yarn shall be 100 percent recyclable. The carpet tile manufacturer shall have a current "take back" program for recycling, reuse, refurbishment and/or repurposing of their product. However, carpet tile purchased under this contract shall not include a separate prepaid fee for future recycling (or similar reuse) activities. Carpet lease programs are unacceptable. In addition, the carpet manufacturer shall have a documented environmental program developed to reduce waste and emissions from their manufacturing and supply processes.

PART 2 PRODUCTS

2.1 CARPET

Provide carpet tile from manufacturer's standard stock. Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Carpet materials and treatments shall be nontoxic and reasonably nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance. Carpet and adhesives shall be low VOC products. Carpet shall bear the CRI Green Label. Carpet type bearing the label will indicate that carpet has been tested and meets the criteria of the CRI Green Label Criteria. Carpet tile shall be of the modular type, identical in size, precision die cut for complete interchangeability. Sides shall be straight and the corners square. Tufts shall be firmly secured at the edges as in the other areas of the carpet tile. Carpet tile must lay flat on a flat surface without curling, warping, buckling, cupping, or doming and without any lumpiness, unevenness, or differences in

thickness in individual tiles or from tile-to-tile. Provide carpet tile that does not stretch or shift position in use when installed according to the carpet tile manufacturer's instructions. Carpet shall permit 90 degree (quarter turn) rotation of individual tiles without visual disruption of pattern.

2.1.1 Physical Characteristics

2.1.1.1 MODULAR CARPET TILE

Carpet shall comply with the following:

a. Carpet Construction: Tufted, Woven or Bonded.

b. Type: Modular tile 500 x 500 mm square minimum and 1 000 x 1 000 mm square maximum with 0.15 percent growth/shrink rate in accordance with ISO 2551.

c. Pile Type: Level-loop or Multilevel loop.

d. Pile Fiber: Commercial 100% branded (federally registered trademark), Type 6, or Type 6,6 nylon.

e. Pile or Wire Height: Minimum 3 mm in accordance with ASTM D 418.

f. Yarn Ply: Minimum 2.

g. Gauge or Pitch: Minimum 26.0/10 cm in accordance with ASTM D 5793.

h. Stitches or Rows/Wires: Minimum 27.0/10 cm.

i. Finished Pile Yarn (Face) Weight: Minimum 730 g per square meter (22 ounces per square yard). This does not include weight of backings. Weight shall be determined in accordance with ASTM D 5848.

j. Average Pile Yarn Density: Minimum 6000, as described in HUD/FHA publication UM-44d (using pile thickness).

k. Dye Method: Solution dyed, Yarn (or Skein) dyed, or Injection dyed.

l. Primary Backing Materials: Those customarily used and accepted by the trade for each type of carpet tile. Use a back coating compound of synthetic resin or natural or synthetic latex compound. Use back coating quantity normally used in the supplier's product.

m. Attached Cushion Backing: Attached cushion shall be chemically frothed, open cell polyurethane with minimum weight of 0.610 kg/square meter (18 oz/square yard) minimum density of 176 kg/cubic meter (11 pounds/cubic foot); or mechanically frothed, open cell polyurethane with minimum weight of 0.745 kg/square meter (22 oz/square yard), minimum density of 224 kg/cubic meter (14 pounds/cubic foot). Minimum cushion thickness of 2.5 mm.

Maximum compression resistance of 34.5 kPa (5 psi) and compression set of 15 percent in accordance with ASTM D 3676. Maximum ash content shall not exceed 50 percent when tested in accordance with ASTM D 297. Cushion shall pass accelerated aging test in accordance with ASTM D 3676.

n. Recycled Content: Use of carpet cushion containing recovered materials, nylon carpet with backing containing recovered carpet, or nylon fiber with recycled content is required (except for manufacturers with programs to recover and reuse the whole tile). Where use of recycled content is a component of the manufacturer's sustainable product program (where the carpet tile itself is not reused intact), the recycled material content shall constitute at least 20 percent of the product.

2.1.2 Performance Requirements

a. ARR (Appearance Retention Rating): Carpet shall be tested and have the minimum 3.0-3.5 (Heavy) ARR when tested in accordance with either the ASTM D 5252(Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.

b. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C in accordance with AATCC 134.

c. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter (Class II) when tested in accordance with ASTM E 648.

d. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 40 N average force for loop pile.

e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC 165 and shall have a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

f. Colorfastness to Light: Colorfastness to light shall comply with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and shall have a minimum 4 grey scale rating after 40 hours.

g. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 440 N/m.

h. Antimicrobial: Nontoxic antimicrobial treatment in accordance with AATCC 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

i. Dimensional Stability: Dimensional stability shall be maintained at +/-, 0.2 percent maximum in according with ISO 2551 (AACHEN

Test).

j. Flexibility: Secondary backing must not crack, flake, craze, or show any other indications of failure when tested as specified below.

2.1.2.1 At 21 Degrees C

Use a 100 by 100 mm specimen. Double the specimen and press flat on itself in any direction. Hold doubled for 5 minutes. Examine for indications of failure while doubled and after pressed flat. Make the examination visually at a distance of 300 mm.

2.1.2.2 At Minus One Degree C

FED-STD-501, Method 6511, using 25 mm mandrel plus or minus 3 mm.

2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives, concrete primers and concrete patching compound for installation of carpet shall be waterproof, nonflammable, have low VOC content, meet the CRI Green Label criteria, and shall be as required by the carpet manufacturer. Provide manufacturer's standard "peel and stick" type self-adhesive backing system or release adhesive. Use of release adhesive shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 60 degrees C in accordance with ASTM D 3278.

2.3 MOLDING

Rubber molding for transitions and similar trim shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 50 mm wide. Provide full selection of manufacturer's colors for coordination with carpets and selection by the government.

2.4 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be consistent with representative manufacturer's patterns and colors as listed below. Products listed are for representation of style, pattern and color and do not preclude the use of another manufacturer's products meeting the requirements of this specification.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, tooled and cast joints, or rough areas larger than 2 mm shall be filled or repaired using material recommended by the carpet or adhesive manufacturer. Trowel notches shall be reduced to a height not greater than 0.8 mm. Floor shall be free of any foreign materials, vacuumed clean and free of dust and dirt. Before beginning work, subfloor shall be tested with adhesive and carpet

to determine "open time" and bond.

3.2 MOISTURE AND ALKALINITY TESTS

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104. Floor pH shall not exceed the manufacturer's written maximum. Where no maximum is established by manufacturer pH shall not exceed 9.0.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet. Ventilation, personal protection, and other safety precautions recommended by the manufacturer of the adhesive shall be followed. Ventilation shall continue for at least 72 hours following installation.

3.4 INSTALLATION

All work shall be performed by installers who are approved by the carpet manufacturer. Installation shall be in accordance with the manufacturer's instructions and CRI 104. Install carpet only after the work of other trades, including painting, is complete. Edges of carpet meeting hard surface flooring shall be protected with molding; installation shall be in accordance with the molding manufacturer's instructions. Ventilation, personal protection, and other safety precautions recommended by the manufacturer of the adhesive shall be followed. Ventilation shall continue for at least 72 hours following installation.

3.4.1 Modular Tile Installation

Modular tiles shall be installed to form a smooth, uniform and secure surface and shall be snugly jointed together. Tiles shall be laid in the direction specified by the manufacturer with accessibility to the subfloor where required. Install carpet wall-to-wall in rooms and areas indicated in room finish schedules. Do not remove protective barrier from adhesive until immediately before tile is positioned. Fit cutouts, such as door jambs, columns, and ducts, neatly and securely. Include all material indicated, specified, or necessary for a completely finished installation. Contractor shall verify all dimensions in the field, including variations in standard room configurations, as well as other conditions affecting the work.

3.4.2 Extra Carpet Tile

Furnish extra carpet tile of the same lot as that installed in manufacturer's original cartons, labeled with product line, pattern, color and any other information necessary to facilitate ordering additional product.

3.5 CLEANING AND PROTECTION

3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Soiled spots and adhesive shall be removed from all other surfaces and materials contaminated by carpet installation. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, non-staining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Allow no traffic on the floor for at least 24 hours following installation. Access shall be restricted to foot traffic only for at least an additional 24 hours. Protective covering shall be removed when directed by the Contracting Officer.

3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap carpet tile pieces, packaging materials and installation support materials shall be removed from site and recycled appropriately according to manufacturer's recycling program.

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SECTION 09720

WALLCOVERINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-D	(2000) Vinyl Coated Fabric Wallcovering

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2003) International Building Code

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC 42-2	(1991) Uniform Building Code Standard No. 42-2, Standard Test Method for Evaluating Room Fire Growth Contribution of Textile Wall Coverings
UBC 8-2	(1994) Uniform Building Code Standard No. 8-2, Standard Test Method for Evaluating Room Fire Growth Contribution of Textile Wall Coverings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265	(2002) Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls
NFPA 286	(2000) Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule #1168	(2003) Adhesive and Sealant Applications

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings and Accessories; G,

Wallcovering manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics. Corner guard and wainscot cap manufacturer's descriptive data.

Primer and Adhesive

Manufacturer's descriptive data, documentation stating physical characteristics, mildew and germicidal characteristics. Submit Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168. Highlight VOC emissions.

SD-04 Samples

Wallcoverings and Accessories; G,

Samples of each indicated type, pattern, and color of wallcovering. Samples of wallcovering shall be minimum 125 x 175 mm and of sufficient size to show pattern repeat.

Samples of each indicated type corner guard and wainscot cap. Samples shall be a minimum of 75 mm long.

Wallcovering Mockup Panels. After vinyl and glass textile wallcovering samples are approved, and prior to starting installation, a minimum 2400 x 2400 mm wallcovering mock-up shall be provided for each color and type of vinyl and glass textile wallcovering, using the proposed primers and adhesives and actual substrate materials. Once approved, the mock-up samples shall remain in the finished construction and be used as a standard of workmanship for installation within the facility. At least 48 hours prior to mock-up installation, the Contractor shall submit written notification to the Contracting Officer's Representative.

SD-07 Certificates

Wallcoverings and Accessories

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

SD-08 Manufacturer's Instructions

Wallcoverings and Accessories

Preprinted installation instructions for wallcovering and accessories, adhesives and primers. Instructions shall include preparation of the substrate.

SD-10 Operation and Maintenance Data

Wallcoverings

SD-12 LEED Documentation

Recycled Content; G,
Rapidly Renewable Materials; G,
Manufacturing Plant Location; G,
VOC Emissions; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content, percentage of materials made from rapidly renewable resources, the location of the manufacturing plant where wallcovering was produced; and VOC emissions for primers and adhesives in accordance with LEED-NC RG.

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for wallcovering products.

1.4 DELIVERY AND STORAGE

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 10 degrees C and within a relative humidity range of 30 to 60 percent. Store wallcovering material in a flat position and protect from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

1.5 ENVIRONMENTAL REQUIREMENTS

Minimum temperature of area to receive wallcovering, before, during, and

after installation, and requirements for conditioning adhesive and wallcovering shall comply with the wallcovering manufacturer's printed instructions. However, in no case shall the area temperature be less than 10 degrees C, 72 hours prior to, during installation, and until the adhesive is dry. A minimum temperature of 13 degrees C shall be maintained thereafter. Observe ventilation and safety procedures specified in the MSDS.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.7 EXTRA MATERIALS

Provide one linear meter of full-width wallcovering of each pattern and color for each 100 linear meters of wallcovering installed. Extra stock shall be of the same manufacturer, type, pattern, color, and lot number as the installed wallcovering. Provide full rolls, packed for storage and marked with content, manufacturer's name, pattern and color name and number and dye lot number. Leave extra stock at the site at a location as directed by the Contracting Officer.

1.8 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of wallcovering with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Wall surfaces and trim are complete and ready for installation of wall covering.

(5) Wall covering materials are installed plumb with all seams and edges true, flush and smooth.

(6) Manufacturer's written instructions are followed at all times during storage and installation of materials.

(7) Surrounding work is protected.

(8) Completed work is cleaned and protected until acceptance.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within

24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings and accessories shall be material designed specifically for the specified use. Vinyl and glass textile wallcovering and borders shall be mercury, cadmium, lead, and chromium free. Wallcoverings shall contain bactericides and mildew inhibitors to protect against microbiological and mildew growth. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84.

2.1.1 Vinyl Wallcovering Type A

Vinyl wallcovering shall be vinyl coated woven or nonwoven fabric. Vinyl wallcovering shall conform to CFFA-W-101-D, Type II (Medium Duty) with a minimum total weight of 441 grams per square meter and 620 grams per linear meter . Width shall be 1320/1371 mm . Vinyl wallcovering shall be tested in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84. A polyvinyl fluoride (PVF) film, 0.0127 mm thick shall be factory applied over the face of the wallcovering. The film shall be transparent (clear), medium gloss.

2.1.2 Glass Textile Wallcovering

Glass textile wallcovering shall be woven glass yarns treated with a modififed starch binder. Glass textile wallcovering shall have a minimum total weight of 45 grams per square meter. Width shall be 1000 mm. Glass textile wallcovering shall be tested in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84. The glass textile wallcovering shall receive a primer coat and finish coat of paint prior to application to the wall. Color shall be as indicated on drawings.

2.2 WALL LINER

Wall liner shall be a non-woven polyester cellulose blend having a minimum weight of 125 g/square meter and a total minimum thickness of 0.33 mm. Wall liner shall be tested in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.3 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer, contain a non-mercury based mildewcide, and comply with local indoor air quality standards. VOC content must be less than the current VOC content limits of SCAQMD Rule #1168. Primer shall permit removal of the wallcovering and protect the wall surface during removal, gypsum wallboard facing paper shall not be damaged during removal of wallcovering. Adhesive shall be strippable. When required, primer and adhesive for

textile wallcovering shall be of the type used for testing to comply with NFPA 265, UBC 42-2, or UBC 8-2 requirements. When substrate color variations show through vinyl and glass textile wallcovering, a white pigmented primer as recommended by the wallcovering manufacturer shall be used to conceal the variations. Adhesive to install cornerguards and wainscot cap shall be of a type recommended by the manufacturer of the cornerguards and wainscot cap.

2.4 COLOR, TEXTURE, AND PATTERN

Unless otherwise noted, color, texture and pattern shall be as indicated on the drawings. Color listed is not intended to limit the selection of equal colors, textures and patterns from other manufacturers. Where alternative manufacturers are proposed, wall covering shall be selected from manufacturer's standard product. Submit full product line samples indicating color, texture and pattern combinations available. Color, texture and/or pattern alone shall be adequate cause for rejection.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify the Contracting Officer in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

3.2.1 General

Walls shall be prepared for proper installation of wallcovering in accordance with wallcovering manufacturers instructions. Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth.

3.2.2 Moisture Content

Surfaces to receive wallcovering shall be dry. Moisture content of gypsum wallboard and plaster to receive wallcovering and the type of moisture meter used shall be as recommended by the wallcovering manufacturer. Plaster surfaces shall age at least 30 days prior to installation of vinyl wallcoverings.

3.2.3 Primer, Sealer and Adhesive

Interior surfaces of new and existing gypsum wallboard shall be primed with a wallcovering primer in accordance with the manufacturer's instructions. As required, white primer shall be used when substrate color variations are visible through thin or light color wallcovering. Interior surfaces of exterior masonry walls shall be sealed to prevent moisture penetration,

then primed with a wallcovering primer in accordance with the manufacturer's instructions. Primers and adhesives shall be prepared and applied in accordance with manufacturers instructions. Surface of walls shall be primed as required by wallcovering manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Wall Liner

Wall liner shall be installed over masonry walls that are to receive wallcovering. Liner shall be installed in accordance with the manufacturer's installation instructions. Liner shall be installed perpendicular to wallcovering to prevent overlapping of seams between liner and wallcovering.

3.3.2 Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. When textile wallcoverings are specified to comply with NFPA 265, ICC IBC (Section 803.5.1 Textile Wall Coverings), UBC 42-2, or UBC 8-2 testing the wallcovering shall be installed in accordance with the manufacturer's installation instructions for compliance with the testing using the same product mounting system, including adhesive. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer. Wainscot shall be aligned for pattern match and continuity across the wall. For prepainted glass textile wallcovering, allow the first coat of paint to dry for a minimum of 24 hours before installation. After the installation is complete, wallcovering shall be vacuumed with a ceiling to floor motion.

3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt, soiling, stain, or residual film. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

-- End of Section --

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SECTION 09840

ACOUSTICAL WALL TREATMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1998) Test Method: Colorfastness to Light

ASTM INTERNATIONAL (ASTM)

ASTM C 423	(2002a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM D 1117	(2001) Evaluating Nonwoven Fabrics
ASTM D 5034	(1995; R 2001) Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO UBC	(2000) Uniform Building Code (3 Vol.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265	(2002) Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

Drawings showing plan locations, panel layout elevations and details. Drawings shall include details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials.

SD-03 Product Data

Installation

Manufacturer's installation instructions and recommended cleaning instructions.

Acoustical Wall Panels

Manufacturer's descriptive data and catalog cuts.

Vinyl Moldings and Attachment Trim

Manufacturer's descriptive data and catalog cuts for "J" and corner moldings and similar accessories.

SD-04 Samples

Acoustical Wall Panels

Fabric swatches, minimum 150 mm wide by 150 mm long. Provide samples of each color/pattern range specified.

Vinyl Moldings and Attachment Trim

Samples of "J" and corner moldings and similar accessories, minimum length 100 mm. Provide actual material samples of manufacturer's full color selection.

SD-07 Certificates

Acoustical Wall Panels

Certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance.

1.3 DELIVERY AND STORAGE

Materials delivered and placed in storage shall be stored with protection from the weather, direct sunlight, humidity and temperature variations, dirt, dust, or other contaminants. Panels shall be allowed to reach a stable temperature and humidity level before installation.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a one year period shall be provided.

1.5 QUALITY ASSURANCE

Do not begin installation of acoustical wall treatment before verifying that all other wall components, electrical, mechanical, specialties, etc. have been installed. Verify that building is enclosed and that temperature and humidity can be maintained in the range intended for occupancy prior to beginning installation of acoustical wall treatment.

1.6 REQUIRED QUANTITY

Acoustical panels shall be mounted and fully concealed under the bottom of pew seat benches, facing the floor, to absorb foot step noise. In addition, provide surface area of 100 square meters of panels for contingent wall surface mounting in the Worship and Activity rooms as directed by the Contracting Officer. Acoustical panels shall be required as necessary to correct acoustical deficiencies of the finished spaces as identified by the government. Configuration, positions and shape of wall panel layout will be provided by the government. Panels shall be mounted on gypsum wall board surfaces only. Provide two distinct colors/patterns of fabric for approval.

1.7 EXTRA MATERIALS

Provide one full size wall panel for each color/pattern used in the work.

PART 2 PRODUCTS

2.1 FABRIC COVERED ACOUSTICAL WALL PANELS

Acoustical wall panels shall consist of prefinished factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below. Wall panels shall be manufactured to the dimensions and configurations shown on the approved detail drawings. Perimeter edges shall be non-reinforced. Acoustical wall panels installed in non-sprinklered areas must comply with the requirements of ICBO UBC, Standard 42-2. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

a. Panel Width: Widths shall be nominal 600 or 750 mm. End panels may vary in width as necessary to cover wall

b. Panel Height: Use single panel for full height shown. Panels shall be field measured for custom fit to ceiling. Tolerance at floor or base as detailed.

c. Thickness: Panel thickness shall be as required to meet the indicated NRC range, but shall not exceed 25 mm.

d. Fabric Coverings:

   Provide fabric type as indicated on drawings.

1. Seamless non-woven, embossed texture, 50 percent polyester and 50 percent polypropylene, minimum 0.034 kg per linear meter. Tear strength shall be minimum 110 N machine direction and minimum 178 N cross-machine direction in accordance with ASTM D 1117. Tensile strength shall be minimum 220 N machine direction and minimum 330 N cross-machine direction in accordance with ASTM D 5034.

2. Seamless plain woven 2-ply 100 percent polyester, minimum 0.47 kg per linear meter. Tear strength shall be minimum 129 N. Tensile strength shall be 667 N minimum in accordance with ASTM D 5034.

Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) shall be approximately 40 hours in accordance with AATCC 16.

e. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84. Shall also pass NFPA 265 Room/Corner Wall Test.

f. Substrate: Mineral fiber.

g. Noise Reduction Coefficient (NRC) Range: 0.60-0.70 per ASTM C 423.

h. Edge Detail: Square edge consistent with spline system used.

i. Core Type: Standard acoustical where bottom of panel is mounted above 4000 mm. Acoustical/tackable core where panels are located below 4000 mm.

j. Mounting: Acoustical/tackable panels shall be mounted by manufacturer's standard concealed spline. Standard acoustical panels shall be mounted with standard concealed spline or adhesive mounting.

k. Color: Fabric color shall be as indicated on the drawings or as selected from the manufacturer's standard range of fabric patterns/colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Installation shall not begin until all wet work, such as, plastering, painting, and concrete are completely dry.

3.2 INSTALLATION

3.2.1 General

Panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels. Panels shall be applied in accordance with the manufacturer's installation instructions. Do not install panels above ceiling level. Maintain and repair/reseal when cut, manufacturer's back of panel seal. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.2.2 Cut Edges

Where panels must be cut to fit, locate vertical edges at wall surface perimeter against intersecting wall surfaces or perpendicular acoustical panels. Cut edges occurring in the field of the acoustical installation shall be prepared by cutting just the panel substrate and rewrapping the edge with the protected fabric. Retain at least 75 mm of fabric to ensure complete edge wrap and back fastening. All other cut edges shall be protected with manufacturers standard "J" mold.

3.2.3 Panel Height

Panels shall span the full vertical dimension shown on drawings without splicing. Do not install with horizontal seams between acoustic panels unless specifically indicated on drawings.

3.2.4 Outside Corners

Outside corners of acoustic panel installations shall be protected with the manufacturer's impact resistant corner trim. Corner trim shall be anchored to the underlying wall surface and shall not rely on the acoustical panel for connection support.

3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that cannot be cleaned to the satisfaction of the C.O.R., are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

-- End of Section --

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SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(1991-1992) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC	Documentation of Threshold Limit Values and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 235	Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 523	(1999) Standard Test Method for Specular Gloss
ASTM D 2092	(1995; R 2001e1) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting
ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4444	(1998) Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
ASTM F 1869	(2003) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	Air Contaminants

FEDERAL STANDARDS (FED-STD)

FED-STD-313	(Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

MASTER PAINTERS INSTITUTE (MPI)

MPI 101	(2001) Cold Curing Epoxy Primer
MPI 107	(2001) Rust Inhibitive Primer (Water-Based)

GREEN SEAL

GS Standard GS-11	(2003) Volatile Organic Compound Emissions for Paints

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS-EPP-SP01-01	(2001) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC PA 1	(2000) Shop, Field, and Maintenance Painting
SSPC PA 3	(1995) Safety in Paint Application
SSPC VIS 1	(1989) Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC VIS 3	(1993) Visual Standard for Power- and Hand-Tool Cleaned Steel (Standard Reference Photographs)
SSPC VIS 4	(2001) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
SSPC SP 1	(1982; R 2000) Solvent Cleaning

SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(2000) Power Tool Cleaning
SSPC SP 6	(2000) Commercial Blast Cleaning
SSPC SP 7	(2000) Brush-Off Blast Cleaning
SSPC SP 10	(1994) Near-White Blast Cleaning
SSPC SP 12	(1995) Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultra high-Pressure Water Jetting Prior to Recoating

U. S. GREEN BUILDING COUNCIL

LEED-NC RG	(May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS-EPP-SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Coating; G,

Manufacturer's Technical Data Sheets. VOC emissions from paints and coatings shall not exceed the VOC and chemical component of GS Standard GS-11. Highlight VOC emissions.

SD-04 Samples

Color; G,

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings G,

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, pot life, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings: G,

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

SD-12 LEED Documentation

Manufacturing Plant Location; G
Regionally Extracted Materials; G
VOC Emissions; G

Manufacturer's statement of location of the manufacturing plant where paint or coating was produced, percentage of paint or coatings's raw materials extracted regionally, and VOC emissions for paints and coatings in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for paint and coating products.

1.4 APPLICATOR'S QUALIFICATIONS

1.4.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on concrete, masonry, ferrous metals, wood, gypsum wallboard and plaster on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.5 QUALITY ASSURANCE

1.5.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph

"Testing Procedure." Products that do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

1.5.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one liter samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.5.1.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph "Qualification Testing" laboratory for coatings. The qualification testing lab report shall include the backup data and summary of the test results. The summary shall list all of the reference specification requirements and the result of each test. The summary shall clearly indicate whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If the Contractor chooses MPI to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

1.6 REGULATORY REQUIREMENTS

1.6.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Paints shall comply with GS Standard GS-11 for VOC content. Notify Contracting Officer of any paint specified herein which fails to conform.

1.6.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.6.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.6.4 Asbestos Content

Materials shall not contain asbestos.

1.6.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.6.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.6.7 Human Carcinogens

Materials shall not contain ACGIH Limit Values and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.7 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 4 to 35 degrees C.

1.8 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01525,"Safety Requirements" and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.8.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

1.8.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH Limit Values, threshold limit values.

1.9 ENVIRONMENTAL CONDITIONS

1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 3 degrees C above dew point;

b. Below 10 degrees C, or over 35 degrees C, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.10 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as indicated.

1.11 LOCATION AND SURFACE TYPE TO BE PAINTED

1.11.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.11.1.1 Exterior Painting

Includes new surfaces of the buildings and appurtenances as indicated. Also included are existing coated surfaces made bare by cleaning operations.

1.11.1.2 Interior Painting

Includes new surfaces of the buildings and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.11.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.11.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.11.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads that have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.

b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm. Provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands spaced at maximum of 6 meters intervals throughout the piping systems.

1.11.4 Exterior Painting of Site Work Items

Field coat the following items:

a. Bollards

1.11.5 MISCELLANEOUS PAINTING

Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel. Samples shall be approved before application.

1.11.6 Definitions and Abbreviations

1.11.6.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.11.6.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification.

This testing shall only be accomplished by MPI testing lab.

1.11.6.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.11.6.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.11.6.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.11.6.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.11.6.7 EXT

MPI short term designation for an exterior coating system.

1.11.6.8 INT

MPI short term designation for an interior coating system.

1.11.6.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.11.6.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.11.6.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.11.6.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.11.6.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.11.6.14 Paint

See Coating definition.

1.11.6.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.11.6.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, or SSPC SP 6. Brush-off blast remaining surface in accordance with SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/ SSPC SP 12 WJ-3.

c. Metal Floor Surfaces to Receive Nonslip Coating: Clean in accordance with SSPC SP 10.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7, SSPC SP 6, and SSPC SP 10. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12.

As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4.

3.3.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Water jet to SSPC SP 12 WJ3 degree of cleanliness.

3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

a. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.3.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

3.3.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 0.20 liter trisodium phosphate, 0.1 liter household detergent, 1.6 liters 5 percent sodium hypochlorite solution and 4.8 liters of warm water.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new surfaces with a solution composed of 0.2 liter trisodium phosphate, 0.1 liter household detergent, and 6.4 liters of warm water. Then rinse thoroughly with fresh water. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new surfaces with a solution composed of 0.2 liter trisodium phosphate, 0.1 liter household detergent, 1.6 liters 5 percent sodium hypochlorite solution and 4.8 liters of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 0.4 square meter of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F 1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.4.2 Gypsum Board, Plaster, and Stucco

a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.5.1 New Plywood and Wood Surfaces, Except Floors:

a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

b. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.

c. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.

d. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

e. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood: Prior to application of coating, cover knots and stains with two or more coats of 1.3-kg-cut shellac varnish, plasticized with 0.14 liters of castor oil per liter. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

f. Prime Coat For New Exterior Surfaces: Prime coat trim before wood becomes dirty, warped, or weathered.

3.5.2 Interior Wood Surfaces, Stain Finish

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.6 APPLICATION

3.6.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads that have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 0.025 mm. Unfinished spaces include spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs,

drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

e. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.6.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.6.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.6.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table
Division 6. Exterior Wood; Dressed Lumber, Paneling, Decking, Shingles Paint Table

Division 3. Interior Concrete Paint Table
Division 4. Interior Concrete Masonry Units Paint Table
Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table
Division 6. Interior Wood Paint Table
Division 9: Interior Plaster and Gypsum Board Paint Table

b. Minimum Dry Film Thickness (DFT): Apply paints, primers,

varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 0.038 mm each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces that have not been specified, the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.7 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 0.038 mm DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.9 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces that will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

3.10 PIPING IDENTIFICATION

Piping Identification shall be provided for all piping in exposed areas, accessible pipe spaces and surfaces in concealed spaces. Place identification in clearly visible locations. Pipes shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 12 000 mm spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Cold water (non-potable)	Black	Yellow	NON-POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Fire Sprinkler Water	Red	White	FIRE SPR. WATER
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic)	Green	White	H.W.R.
High temp. water supply	Yellow	Black	H.T.W.S.
High temp. water return	Yellow	Black	H.T.W.R.
Boiler feed water	Yellow	Black	B.F.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Condenser water supply	Green	White	COND. W.S.
Condenser water return	Green	White	COND. W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Treated water	Green	White	TR. WATER
Chemical feed	Yellow	Black	CH. FEED
Compressed air	Blue	White	COMP. AIR
Natural gas	Yellow	Black	NAT. GAS
Propane Gas	Yellow	Black	PROP. GAS

Refrigerants	Blue	White	REFRIGERANT
Fuel oil	Yellow	Black	FUEL OIL
Steam	Yellow	Black	STEAM
Condensate	Yellow	Black	CONDENSATE

TABLE I. COLOR CODES FOR MARKING PIPE (cont.)

Material	Band	Letters and Arrow*	Legend
Hydraulic fluid under 4.1 MPa (600 psi)	Green	White	HYDRAULIC FLUID-__PSI
Hydraulic fluid 4.1 MPa (600 psi) and Greater	Yellow	Black	HYDRAULIC FLUID-__PSI

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (mm)	Width of Color Band (mm)	Arrow Length x Width (mm)	Size of Legend Letters and Numerals (mm)
Less than 38	200	200 x 57	13
38 to 60	200	200 x 57	19
60 to 150	300	200 x 57	31
200 to 225	600	300 x 110	63
Over 250	800	300 x 115	88

3.11 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.12 PAINT TABLES

All DFT's are minimum values.

3.12.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

1. Alkyd
   New; MPI EXT 5.1Q-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 23	MPI 94	MPI 94

   System DFT: 131 microns

B. New Steel that has been blast-cleaned to SSPC SP 6:

1. Alkyd
   New; MPI EXT 5.1D-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 94	MPI 94

   System DFT: 131 microns

C. Not Used

D. New steel blast cleaned to SSPC SP 10:

1. Waterborne Light Industrial
   MPI EXT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 110-G5

   System DFT: 212 microns

E. Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations.:

1. Alkyd Floor Enamel
   MPI EXT 5.1S-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 27	MPI 27 (+NSA)

   System DFT: 131 microns

EXTERIOR GALVANIZED SURFACES

F. New Galvanized surfaces:

1. MPI EXT 5.3H-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 134	MPI 11	MPI 11

   System DFT: 112 microns

G. Galvanized surfaces with slight coating deterioration; little or no rusting:

1. Waterborne Light Industrial Coating
   MPI REX 5.3J-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 134	N/A	MPI 110-G5

   System DFT: 112 microns

H. Galvanized surfaces with severely deteriorated coating or rusting:

1. Waterborne Light Industrial Coating
   MPI REX 5.3L-G5(Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 101 MPI 108 MPI 110-G5
   System DFT: 212 microns

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

I. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment. Match surrounding finish:

1. Alkyd
   MPI EXT 5.4F-G5 (Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 95 MPI 94 MPI 94
   System DFT: 125 microns

2. Waterborne Light Industrial Coating
   MPI EXT 5.4G-G5(Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 95 MPI 110-G5 MPI 110-G5
   System DFT: 125 microns

I. Not Used

J. Surfaces adjacent to painted surfaces; Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. Alkyd
   MPI EXT 5.1D-G5 (Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 79 MPI 94 MPI 94
   System DFT: 131 microns

2. Waterborne Light Industrial Coating
   MPI EXT 5.1C-G5(Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 79 MPI 110-G5 MPI 110-G5
   System DFT: 125 microns

K. Hot metal surfaces subject to temperatures up to 205 degrees C (400 degrees F):

1. Heat Resistant Enamel
   MPI EXT 5.2A
   Primer: Intermediate: Topcoat:
   MPI 21 Surface preparation and number of coats per manufacturer's instructions.
   System DFT: Per Manufacturer

L. Ferrous metal subject to high temperature, up to 400 degrees C (750 degrees F):

1. Inorganic Zinc Rich Coating
   MPI EXT 5.2C
   Primer: Intermediate: Topcoat:
   MPI 19 Surface preparation and number of coats per manufacturer's instructions.
   System DFT: Per Manufacturer

2. Heat Resistant Aluminum Enamel
   MPI EXT 5.2B (Aluminum Finish)
   Primer: Intermediate: Topcoat:
   MPI 2 Surface preparation and number of coats per manufacturer's instructions.
   System DFT: Per Manufacturer

M. Not Used

DIVISION 6: EXTERIOR WOOD; DRESSED LUMBER AND PANELING PAINT TABLE

A. New Dressed lumber, Wood and plywood, and trim:

1. Alkyd
   MPI EXT 6.3B-G5 (Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 7 MPI 94 MPI 94
   System DFT: 125 microns

2. Latex
   MPI EXT 6.3A-G5 (Semigloss)
   Primer: Intermediate: Topcoat:
   MPI 7 MPI 11 MPI 11
   System DFT: 125 microns

3. Waterborne Solid Color Stain
   MPI EXT 6.3K
   Primer: Intermediate: Topcoat:
   MPI 7 MPI 16 MPI 16
   System DFT: 106 microns

B. Not Used

C. Not Used

D. Not Used

E. Not Used

F. Not Used

G. Not Used

DIVISION 9: EXTERIOR STUCCO PAINT TABLE

A. New stucco:

1. Latex
New; MPI EXT 9.1A-G1 (Flat)

Primer:	Intermediate:	Topcoat:
MPI 10	MPI 10	MPI 10

System DFT: 112 microns

New; MPI EXT 9.1A-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 11	MPI 11	MPI 11

System DFT: 112 microns

Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.

B. New stucco, elastomeric system:

1. Elastomeric Coating
New; MPI EXT 9.1C / Existing; MPI REX 9.1C

Primer:	Intermediate:	Topcoat:
N/A	MPI 113	MPI 113

System DFT: 400 microns

Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and # of coats in accordance with manufacturer's instructions.

NOTE: Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 400 microns.

3.12.2 INTERIOR PAINT TABLES

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. New Concrete, vertical surfaces, not specified otherwise:

1. Latex
New; MPI INT 3.1A-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 52	MPI 52

System DFT: 100 microns

New; MPI INT 3.1A-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 54	MPI 54

System DFT: 100 microns

2. Institutional Low Odor / Low VOC Latex
New; MPI INT 3.1M-G4 (satin)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 146	MPI 146

System DFT: 100 microns

New; MPI INT 3.1M-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 147	MPI 147

System DFT: 100 microns

B. Concrete ceilings, uncoated:

1. Latex Aggregate
MPI INT 3.1N

Primer:	Intermediate:	Topcoat:
N/A	N/A	MPI 42

System DFT: Per Manufacturer

Texture - Medium. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions.
Topcoat: Coating to match adjacent surfaces.

C. New Concrete in toilets, restrooms, laundry areas, and shower areas, and other high-humidity areas not otherwise specified except floors:

1. Waterborne Light Industrial Coating
New; MPI INT 3.1L-G3(Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 110-G3	MPI 110-G3	MPI 110-G3

System DFT: 120 microns

New; MPI INT 3.1L-G5(Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 110-G5	MPI 110-G5	MPI 110-G5

System DFT: 120 microns

2. Alkyd
New; MPI INT 3.1D-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 51	MPI 51

System DFT: 112 microns

MPI INT 3.1D-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 47	MPI 47

System DFT: 112 microns

3. Epoxy
New; MPI INT 3.1F-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 77	MPI 77	MPI 77

System DFT: 100 microns

Note: Primer may be reduced for penetration per manufacturer's instructions.

D. Not Used

E. Not Used

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. New Concrete masonry:

1. High Performance Architectural Latex
MPI INT 4.2D-G3 (Eggshell)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 139	MPI 139

System DFT: 275 microns

MPI INT 4.2D-G4 (Satin)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 140	MPI 140

System DFT: 275 microns

MPI INT 4.2D-G5 (Semigloss)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 141	MPI 141

System DFT: 275 microns

Fill all holes in masonry surface

2. Institutional Low Odor / Low VOC Latex
New; MPI INT 4.2E-G3 (Eggshell)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 145	MPI 145

System DFT: 100 microns

New; MPI INT 4.2E-G4 (Satin)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 146	MPI 146

System DFT: 100 microns

New; MPI INT 4.2E-G5 (Semigloss)

Filler	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 147	MPI 147

System DFT: 100 microns

B. Not Used

C. New Concrete masonry units in toilets, restrooms, laundry areas, shower areas, and other high humidity areas unless otherwise specified:

1. Waterborne Light Industrial Coating
MPI INT 4.2K-G3(Eggshell)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 110-G3	MPI 110-G3

System DFT: 275 microns

MPI INT 4.2K-G5(Semigloss)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 4	N/A	MPI 110-G5	MPI 110-G5

System DFT: 275 microns

Fill all holes in masonry surface

2. Alkyd
MPI INT 4.2N-G3 (Eggshell)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 4	MPI 50	MPI 51	MPI 51

System DFT: 300 microns

MPI INT 4.2N-G5 (Semigloss)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 4	MPI 50	MPI 47	MPI 47

System DFT: 300 microns

MPI INT 4.2N-G6 (Gloss)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 4	MPI 50	MPI 48	MPI 48

System DFT: 300 microns

Fill all holes in masonry surface

D. Not Used

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. High Performance Architectural Latex
MPI INT 5.1R-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 139	MPI 139

System DFT: 125 microns

MPI INT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 141	MPI 141

System DFT: 125 microns

2. Alkyd
MPI INT 5.1E-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 51	MPI 51

System DFT: 131 microns

MPI INT 5.1E-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 47	MPI 47

System DFT: 131 microns

B. Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations.:

1. Alkyd Floor Paint
   MPI INT 5.1U-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 27	MPI 27 (+NSA)

   System DFT: 131 microns

2. Epoxy
   MPI INT 5.1L-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 77	MPI 77 (+NSA)

   System DFT: 131 microns

C. Metal in toilets, restrooms, laundry areas, shower areas, and other high-humidity areas not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. Alkyd
   MPI INT 5.1E-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 51	MPI 51

   System DFT: 131 microns

   MPI INT 5.1E-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 47	MPI 47

   System DFT: 131 microns

   MPI INT 5.1E-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 48	MPI 48

   System DFT: 131 microns

D. Ferrous metal in concealed damp spaces or in exposed areas having unpainted adjacent surfaces as follows:

1. Aluminum Paint
   MPI INT 5.1M

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 1	MPI 1

   System DFT: 106 microns

E. Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. High Performance Architectural Latex
   MPI INT 5.4F-G4 (Satin)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 140	MPI 140

System DFT: 125 microns

MPI INT 5.4F-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 141	MPI 141

System DFT: 125 microns

2. Alkyd

MPI INT 5.4J-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 47	MPI 47

System DFT: 125 microns

MPI INT 5.4J-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 48	MPI 48

System DFT: 125 microns

F. Hot metal surfaces subject to temperatures up to 205 degrees C (400 degrees F):

1. Heat Resistant Enamel

MPI INT 5.2A

Primer:	Intermediate:	Topcoat:
MPI 21	Surface preparation and number of coats per manufacturer's instructions.	

System DFT: Per Manufacturer

G. Not Used

H. Not Used

DIVISION 6: INTERIOR WOOD PAINT TABLE

A. New Wood and plywood not otherwise specified:

1. High Performance Architectural Latex

MPI INT 6.4S-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 39	MPI 139	MPI 139

System DFT: 112 microns

MPI INT 6.4S-G4 (Satin)

Primer:	Intermediate:	Topcoat:
MPI 39	MPI 140	MPI 140

System DFT: 112 microns

2. Alkyd

MPI INT 6.4B-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 45	MPI 51	MPI 51

System DFT: 112 microns

3. Institutional Low Odor / Low VOC Latex

New; MPI INT 6.3V-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 39	MPI 145	MPI 145

System DFT: 100 microns

New; MPI INT 6.3V-G4 (Satin)

Primer:	Intermediate:	Topcoat:
MPI 39	MPI 146	MPI 146

System DFT: 100 microns

B. Not Used

C. New Wood and Plywood, except floors; natural finish or stained:

1. Natural finish, oil-modified polyurethane

New; MPI INT 6.4J-G4

Primer:	Intermediate:	Topcoat:
MPI 57	MPI 57	MPI 57

System DFT: 100 microns

New; MPI INT 6.4J-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 56	MPI 56	MPI 56

System DFT: 100 microns

2. Stained, oil-modified polyurethane

New; MPI INT 6.4E-G4

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 57	MPI 57	MPI 57

System DFT: 100 microns

New; MPI INT 6.4E-G6 (Gloss)

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 56	MPI 56	MPI 56

System DFT: 100 microns

3. Stained, Moisture Cured Urethane

New; MPI INT 6.4V-G2 (Flat)

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 71	MPI 71	MPI 71

System DFT: 100 microns

New; MPI INT 6.4V-G6 (Gloss)

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 31	MPI 31	MPI 31

System DFT: 100 microns

D. Not used

E. Not Used

F. New wood surfaces in toilets, restrooms, laundry areas, shower areas, and other high humidity areas not otherwise specified.:

1. Waterborne Light Industrial

MPI INT 6.3P-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 45	MPI 110-G5	MPI 110-G5

System DFT: 112 microns

MPI INT 6.3P-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 45	MPI 110-G6	MPI 110-G6

System DFT: 112 microns

3. Alkyd

MPI INT 6.3B-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 45	MPI 47	MPI 47

System DFT: 112 microns

MPI INT 6.3B-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 45	MPI 48	MPI 48

System DFT: 112 microns

G. Not Used

H. New Wood Doors; Natural Finish or Stained (not factory finished:

1. Natural finish, oil-modified polyurethane

New; MPI INT 6.3K-G4

Primer:	Intermediate:	Topcoat:
MPI 57	MPI 57	MPI 57

System DFT: 100 microns

New; MPI INT 6.3K-G6 (Gloss)

Primer:	Intermediate:	Topcoat:
MPI 56	MPI 56	MPI 56

System DFT: 100 microns

Note: Sand between all coats per manufacturers recommendations.

2. Stained, oil-modified polyurethane

New; MPI INT 6.3E-G4

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 57	MPI 57	MPI 57

System DFT: 100 microns

New; MPI INT 6.3E-G6 (Gloss)

Stain:	Primer:	Intermediate:	Topcoat:
MPI 90	MPI 56	MPI 56	MPI 56

System DFT: 100 microns

Note: Sand between all coats per manufacturers recommendations.

3. Stained, Moisture Cured Urethane

New; MPI INT 6.4V-G6 (Gloss)

Stain:	Primer:	Intermediate:	Topcoat:

MPI 90 MPI 31 MPI 31 MPI 31
System DFT: 100 microns

Note: Sand between all coats per manufacturers recommendations.

I. New Wood Doors; Pigmented finish:

1. Alkyd
New; MPI INT 6.3B-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 45 MPI 47 MPI 47
System DFT: 112 microns

New; MPI INT 6.3B-G6 (Gloss)
Primer: Intermediate: Topcoat:
MPI 45 MPI 48 MPI 48
System DFT: 112 microns

Note: Sand between all coats per manufacturers recommendations.

2. Pigmented Polyurethane
New; MPI INT 6.1E-G6 (Gloss)
Primer: Intermediate: Topcoat:
MPI 72 MPI 72 MPI 72
System DFT: 112 microns

Note: Sand between all coats per manufacturers recommendations.

J. Not Used

1. Alkyd
New; MPI RIN 6.3B-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 46 MPI 47 MPI 47
System DFT: 112 microns

New; MPI RIN 6.3B-G6 (Gloss)
Primer: Intermediate: Topcoat:
MPI 46 MPI 48 MPI 48
System DFT: 112 microns

Note: Sand between all coats per manufacturers recommendations.

DIVISION 9: INTERIOR PLASTER AND GYPSUM BOARD, PAINT TABLE

A. New Plaster and Gypsum Wallboard not otherwise specified:

1. Latex
New; MPI INT 9.2A-G3 (Eggshell)
Primer: Intermediate: Topcoat:
MPI 50 MPI 52 MPI 52
System DFT: 100 microns

New; MPI INT 9.2A-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 54	MPI 54

System DFT: 100 microns

2. High Performance Architectural Latex - High Traffic Areas
   New; MPI INT 9.2B-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 139	MPI 139

System DFT: 100 microns

   New; MPI INT 9.2B-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 141	MPI 141

System DFT: 100 microns

3. Institutional Low Odor / Low VOC Latex
   New; MPI INT 9.2M-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 145	MPI 145

System DFT: 100 microns

   New; MPI INT 9.2M-G4 (Satin)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 146	MPI 146

System DFT: 100 microns

   New; MPI INT 9.2M-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 147	MPI 147

System DFT: 100 microns

B. New Plaster and Wallboard in toilets, restrooms, laundry areas, shower areas, and other high humidity areas not otherwise specified.:

1. Waterborne Light Industrial Coating
   New; MPI INT 9.2L-G5(Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 110-G5	MPI 110-G5

System DFT: 100 microns

2. Alkyd
   New; MPI INT 9.2C-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 47	MPI 47

System DFT: 100 microns

-- End of Section --

SECTION 09915

COLOR COORDINATION

PART 1 GENERAL

1.1 GENERAL

The occupancy type for this facility places additional importance on the aesthetic value of the building. Thus it is particularly important that finish colors are carefully coordinated. This section covers only the color coordination of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color, pattern and texture. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. When color is not designated for items, the Contractor shall propose a color for approval.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Color Schedule

Provide color boards, 90 days after the Contractor is given Notice to proceed, complying with the following requirements:

a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.

b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.

c. Samples shall be on size 8-1/2 by 11 inch boards with a maximum spread of size 25-1/2 by 33 inches for foldouts.

d. Samples for these color boards are required in addition to samples requested in other specification sections.

e. Color boards shall be provided separately for each room or area type with a distinct color palette. Materials that are not visible within a common area shall not be combined on a single color board.

f. Separate color boards shall be provided for exterior

materials.

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers. However, equivalent colors must work harmoniously with other finishes as determined by the Contracting Officer. Color alone is sufficient cause for rejection of a submittal.

2.2 SCHEDULED COLORS

The various finish and component schedules in the drawings list colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors.

2.3 UNSCHEDULED COLORS

Placement of color shall be in accordance with the following schedule. Other unscheduled colors shall be submitted by the contractor for approval.

2.3.1 Roof Penetrations

Materials penetrating the roof surface shall be finished to match the roof.

2.3.2 Conduit, Pipe and Ductwork

Conduit, pipe or ductwork that is impossible to conceal from view in finished construction shall be painted to match adjacent surface color(s) and maximize visual blending.

2.3.3 Fasteners and Miscellaneous Metals

Fasteners and miscellaneous metals exposed to view shall be painted or otherwise color finished to match adjacent surface and otherwise limit visibility.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 10100

VISUAL COMMUNICATIONS SPECIALTIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1994) Safety Glazing Materials Used in Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C 1048	(1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM F 148	(2002) Binder Durability of Cork Composition Gasket Materials
ASTM F 152	(1995; R 2002) Tension Testing of Nonmetallic Gasket Materials

1.2 GENERAL REQUIREMENTS

The term visual display board when used herein includes presentation boards, marker boards, tackboards, board cases, display track system and horizontal sliding units. Visual display boards shall be from manufacturer's standard product line.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Visual Display Boards; G

Projection Screens; G

Manufacturer's descriptive data and catalog cuts. Manufacturer's installation instructions, and cleaning and maintenance instructions.

SD-04 Samples

Aluminum; G

Sections of frame, map rail, and marker tray, map hooks and other accessories.

Porcelain Enamel; G

Section showing porcelain enamel coating, steel, core material and backing.

Materials; G

Section of core material showing the lamination of colored cork, natural cork, woven fabric, non-woven fabric, and vinyl wall covering. Sample of hardwood and plastic laminate finish, and glass type. Samples shall be minimum 100 by 100 mm and show range of color.

07 Certificates

Visual Display Boards;

Certificate of compliance signed by Contractor attesting that visual display boards conform to the requirements specified.

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area with temperature maintained above 10 degrees C. Materials shall be stacked according to manufacturer's recommendations. Visual display boards shall be allowed to acclimate to the building temperature for 24 hours prior to installation.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to

assure compliance of postal specialties with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verification of proper operation of all equipment and hardware.

(5) Protection of all items until facility occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 COLOR

Marker boards shall be white unless indicated otherwise. Finish colors for frames and trim shall be as indicated on the drawings.

2.2 MATERIALS

2.2.1 Porcelain Enamel

Marker board writing surface shall be composed of 5 mil minimum thickness porcelain enamel fused to a nominal 0.60 mm (24 gauge) thick steel sheet, laminated to minimum 12 mm thick core material with a steel or foil backing sheet. Porcelain steel sheet shall conform to ASTM C 346 Type 54T and meet PEI S104. Writing surface shall be capable of supporting paper by means of magnets. Marker board surface for display track system may be a powder paint dry erase surface adhered to a nominal 1.214 mm (18 gauge) thick steel.

2.2.2 Cork

Cork shall be a continuous resilient sheet made from soft, clean, granulated cork relatively free from hardback and dust and bonded with a binder suitable for the purpose intended. The wearing surface shall be free from streaks, spots, cracks or other imperfections that would impair its usefulness or appearance. The material shall be seasoned, and a clean cut made not less than 13 mm from the edge shall show no evidence of soft sticky binder.

2.2.2.1 Colored Cork

Colored cork shall be composed of pure cork and natural color pigments that

are combined under heat and pressure with linseed oil. Colored cork shall be colored throughout and shall be washable. The burlap backing shall be deeply imbedded and keyed to the work sheet being partially concealed in it and meeting the requirements of ASTM F 148.

2.2.2.2 Natural Cork

Material shall be a single layer of pure grain natural cork without backing or facing. The color shall be light tan. The cork sheet shall have a tensile strength of not less than 275 kPa when tested in accordance with ASTM F 152.

2.2.3 Woven Fabric

Fabric shall be plain weave. Fiber content shall be 100 percent polyester. Minimum total weight shall be 496 grams plus or minus 14 grams per linear meter (16 oz. plus or minus 0.5 oz. per linear yard). Fabric shall have a Class A flame spread rating of 0-50 and smoke development rating of 0-450 in accordance with ASTM E 84.

2.2.4 Non-Woven Fabric

Fabric shall be non-woven and hooktape compatible. Fiber content shall be 100 percent polyester, 100 percent polyolefin or 100 percent nylon. Minimum total weight shall be 340 grams plus or minus 14 grams per linear meter (11 oz. plus or minus 0.5 oz. per linear yard) for 1524 mm (60 inch) wide fabric. Fabric shall have a Class A flame spread rating of 0-50 and smoke development rating of 0-450 in accordance with ASTM E 84.

2.2.5 Aluminum

Aluminum frame extrusions shall be alloy 6063-T5 or 6063-T6, conform to ASTM B 221M , and be a minimum 1.5 mm thick. Exposed aluminum shall have an anodized, satin finish. Straight, single lengths shall be used wherever possible. Joints shall be kept to a minimum. Corners shall be mitered and shall have a hairline closure.

2.2.6 Hardwood

Exposed hardwood for frames, cabinets, and cases shall be oak, walnut or mahogany. Hardwood shall be provided with a durable factory-applied stain and lacquer finish of a type standard with the manufacturer.

2.2.7 Glass

Glass shall be comprised of tempered glass in accordance with ANSI Z97.1 and shall conform to ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class I (clear), thickness as specified.

2.3 MARKERBOARD

Markerboard shall have a porcelain enamel writing surface for dry erase markers, a map rail, map hooks and a marker tray. Markerboard shall be a factory assembled unit complete in one piece, without joints whenever

possible. When markerboard dimensions require delivery in separate sections, components shall be prefit at the factory, disassembled for delivery and jointed at the site. Frame shall be aluminum. Marker tray shall be the same material as the frame and extend the full length of the markerboard. The map rail with a tackable insert shall extend the full length of the marker board, and shall have map hooks with clips for holding sheets of paper. Two map hooks shall be provided for each 1220 mm of map rail. Dry erase markings shall be removable with a felt eraser or dry cloth without ghosting. Each unit shall come complete with an eraser and four different color compatible dry erase markers. The size shall be as shown on the drawings.

2.4 TACKBOARDS

2.4.1 Cork

Tackboard shall consist of a minimum 6 mm thick natural cork laminated to a minimum 6 mm thick hardboard or particleboard or 13 mm thick fiberboard, and shall have an aluminum frame. The size shall be as shown on the drawings.

2.4.2 Fabric Covered

Tackboard shall have a woven fabric covering laminated to a minimum 6 mm thick cork laminated to a minimum 6 mm thick hardboard or particleboard or 13 mm thick fiberboard, and shall have an aluminum frame. The size shall be as shown on the drawings.

2.5 PROJECTION SCREEN

2.5.1 Motorized Screen

Ceiling recess mounted motorized projection screen shall have 120V motor that is lubricated for life, quick reversal type, has overload protector, integral gears, and preset accessible limit switches. Recessed mount projection screens shall have an operable closure door and access panel. Screen shall be front projection type, flame retardant, mildew resistant, seamless, washable, and white matte with black masking borders. Screen shall be 100 percent brighter than standard matte white screens with minimum gain shall of 1.5 and viewing angle up to 120 degrees. Screen shall be color corrected for CRT projectors and perform well for slide or overhead projectors. Bottom of screen fabric shall be weighted with metal rod. Roller shall be a rigid metal at least 75 mm in diameter mounted on sound absorbing supports. Motor will be end mounted design. Screen shall have a 3 position control switch to stop or reverse screen at any point. The switch shall be installed in a flush electrical box with cover plate, location(s) as shown on the electrical drawings. All conduit and wiring from the control switch to the projection screen shall be furnished and installed by the Contractor. Ceiling recessed case shall be extruded aluminum. Screen shall be UL listed. The size shall be as shown on the drawings.

2.5.2 Manual Screen

Wall mounted projection screen shall be mounted to wall with brackets designed to rigidly hold screen. Screen shall be front projection type, flame retardant, mildew resistant, seamless, washable, and white matte with black masking borders. Screen shall be 100 percent brighter than standard matte white screens with minimum gain shall of 1.5 and viewing angle up to 120 degrees. Screen shall be color corrected for CRT projectors and perform well for slide or overhead projectors. Bottom of screen fabric shall be weighted with metal rod. Roller shall be a rigid metal at least 75 mm in diameter mounted on sound absorbing supports. Wall mounted case shall be aluminum or steel, flat black in color. Screen shall be UL listed. The size shall be as shown on the drawings.

PART 3 EXECUTION

3.1 PLACEMENT SCHEDULE

Location and mounting height of visual display boards and projection screens shall be as shown on the drawings.

3.1.1 Visual Display Boards

Visual display boards shall be provided as follows:

Room Name and Number	Board Type	Board Size
117 Classroom	Marker	2 800 x 1 200
119A Classroom	Marker	2 400 x 1 200
119B Classroom	Marker	2 400 x 1 200
125 Multi-purpose	Marker/Tack	1 400 x 1 200 / (2) 800 x 1 200
130A Classroom	Marker	2 400 x 1 200
130B Classroom	Marker	2 400 x 1 200
131A Classroom	Marker	2 100 x 1 200
131A Classroom	Marker/Tack	3 000 x 1 200 / (2) 900 x 1 200
131B Classroom	Marker	2 100 x 1 200
133 Multi-purpose	Marker/Tack	1 400 x 1 200 / (2) 800 x 1 200
137A Classroom	Marker	2 400 x 1 200
137B Classroom	Marker	2 400 x 1 200
142 Classroom	Marker (2)	3 000 x 1 200 & 2 400 x 1 200
143 Classroom	Marker (2)	3 000 x 1 200 & 2 400 x 1 200
146 Child's Chapel	Marker	2 400 x 1 200

3.1.2 Projection Screens

Projection screens shall be provided as follows:

Room Name and Number	Board Type	Screen Size
100A Worship Center	Motorized/Recessed (2 units)	4 270 x 3 050
100C Activity Area	Motorized/Ceiling Mounted	3 600 x 3 050
125 Multi-Purpose	Motorized/Recessed	2 400 x 1 800
130A Classroom	Manual/Wall Mounted	2 400 x 1 800

Room Name and Number	Board Type	Screen Size
133 Multi-Purpose	Motorized/Recessed	2 400 x 1 800

3.2 INSTALLATION

Installation and assembly shall be in accordance with manufacturer's printed instructions. Concealed fasteners shall be used or mount to wall with concealed hanger bar type mounting system.. Visual display boards shall be attached to the walls with suitable devices to anchor each unit. Provide continuous blocking or bridging in stud walls at the perimeter of all display boards. The Contractor shall furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. Visual display boards shall be installed in locations and at mounting heights indicated. Visual display boards shall be installed level and plumb, and if applicable doors shall be aligned and hardware shall be adjusted. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

3.3 CLEANING

Writing surfaces shall be cleaned in accordance with manufacturer's instructions. Protect all surfaces until occupancy.

-- End of Section --

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SECTION 10153

TOILET PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003	(Basic) Partitions, Toilet, Complete

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G,

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-03 Product Data

Toilet Partition System; G

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Samples

Colors and Finishes; G

Manufacturer's standard color charts and color samples.

1.3 SYSTEM DESCRIPTION

Toilet partition system shall be a complete and usable system of panels, hardware, and support components. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. The partition system shall be provided by a single manufacturer, and shall be a standard product as shown in the most recent catalog data. The partition system shall be as shown.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated; free from dust, water, or other contaminants; and shall have easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to CID A-A-60003, Type I, Style A, floor supported. Provide additional wall studs and solid backing within walls at partition attachment points. Accessible enclosures shall conform to 36 CFR 1191 ADAAG dimensional requirements. Width, length, and height of toilet enclosures shall be as shown. Panels shall be solid high density polyethylene (HDPE) consistent with "Finish 5". Panels indicated to receive accessory items such as toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES, shall be reinforced for mounting of the items required. Grab bars shall withstand a bending stress, shear stress, shear force, and a tensile force induced by 1112 N. Grab bars shall not rotate within their fittings.

2.2 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware finish shall be stainless steel and highly resistant to alkalis, urine, and other common toilet room acids. Latching devices and hinges for accessible compartments shall comply with 36 CFR 1191 and shall be stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Provide manufacturer's standard combination coat hook and bumper on all doors.

2.3 COLORS AND FINISHES

2.3.1 Colors

Color of finishes for toilet partition system components shall be as indicated on drawings. Where an alternate manufacturer is proposed,

provide the full range of standard colors for approval. Color alone shall be cause for rejection of partitions.

2.3.2 Finish No. 5

Solid plastic fabricated of polymer resins (polyethylene) formed under high pressure rendering a single component section not less than 25 mm thick. Colors shall extend throughout the panel thickness. Exposed finish surfaces shall be smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 27 degrees C for a minimum of 30 days:

Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
Acetone	Hydrogen Peroxide (30 percent)
Ammonia (liquid)	Isopropyl Alcohol
Ammonia Phosphate	Lactic Acid (25 percent)
Bleach (12 percent)	Lime Sulfur
Borax	Nicotine
Brine	Potassium Bromide
Caustic Soda	Soaps
Chlorine Water	Sodium Bicarbonate
Citric Acid	Trisodium Phosphate
Copper Chloride	Urea; Urine
Core Oils	Vinegar

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb with uniform clearance of 13 mm between pilasters and panels; 25 mm between pilasters and walls; and not more than 5 mm between pilasters and doors, in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting or toggle-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work. Do not through drill slab and decking at elevated floor systems. Provide sealant at all floor anchors. In the finished work, conceal evidence of drilling in floors and walls. Screws and bolts shall be stainless steel.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 5 mm and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

-- End of Section --

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SECTION 10201

METAL WALL LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL(AMCA)

AMCA 500-D	(1998) Laboratory Methods of Testing Dampers for Rating
AMCA 511	(1999; R 2002) Certified Ratings Program for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA 45	(2003) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611	(1998) Voluntary Specification for Anodized Architectural Aluminum; includes 604.2, 606.1, 607.1 and 608.1 (which are no longer available as separate documents)

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 366/A 366M	(1997e1) Commercial Steel, Sheet, Carbon,(0.15 Maximum Percent Cold-Rolled**
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers

Show all information necessary for fabrication and installation of louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

SD-03 Product Data

Louvers and Vents; G

Finishes; G

Accessory Items; G

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of louver and vent, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Wall louvers; G

Door louvers; G

Colors of finishes shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Regionally Extracted Materials; G

Manufacturer's statement of material's post-consumer and

post-industrial recycled content, location of the manufacturing plant where louvers were produced, and percentage of louvers' raw materials extracted regionally in accordance with LEED-NC RG

1.3 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for metal louver products.

1.4 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of louvers and vents with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Installation provides a weathertight opening.

(5) All finishes and colors are as indicated.

(6) Installed materials are protected from damage.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A 653/A 653M, coating designation Z275.

2.1.2 Aluminum Sheet

ASTM B 209M, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B 221M, alloy 6063-T5 or -T52.

2.1.4 Stainless Steel

ASTM A 167, Type 302 or 304, with 2B finish.

2.1.5 Cold Rolled Steel Sheet

ASTM A 366/A 366M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

Louvers shall be weather resistant type equipped with "storm" profile head channel and blades incorporating drain gutters and vertical downspouts to limit water penetration and efficiently drain water out at a sloped lower sill. Blades shall be positioned at 35 to 45 degree angle at nominal 150 mm on center.
Provide with internal bird screens. Louvers shall be designed to withstand a wind load of not less than 1.44 kilopascals. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall show a water penetration of 0.06 kilograms or less per square meter of free area at a free velocity of 244 meters per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 2 mm.

2.2.2 Formed Metal Louvers

Formed of zinc-coated or stainless steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 3 mm thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions for all louvers more than 1500 mm in width at not more than 1500 mm on centers. Provide mullions with covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 12.5 mm square mesh, 1.8 or 1.5 mm aluminum bird screening. For steel louvers, provide 12.5 mm square mesh, 2.5 or 1.5

mm zinc-coated steel; 12.5 mm square mesh, 1.5 mm copper; or 6 mm square mesh, 1.5 mm thick zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers. Screens shall be mounted on inside face of louver.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Provide factory-applied finish/coatings as indicated.

2.4.1.1 Fluoropolymer Coating

Exposed surfaces of aluminum louvers and flashing systems shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.005 to 0.008 mm (0.20 to 0.030 mils) and a color coat of minimum 0.025 mm (1.0 mils), total dry film thickness of 0.030 to 0.033 mm (1.2 to 1.3 mils). Finish shall be free of scratches and other blemishes. The system shall require no scheduled recoating to maintain its performance or for UV resistance.

2.4.1.2 Anodic Coating

Exposed surfaces of aluminum louvers and flashing shall have an anodized finish conforming to AA 45 and AAMA 611. Finish shall be Architectural Class I (0.0175 mm or thicker), designation AA-M10-C22-A42, integral color anodized. Finish shall be free of scratches and other blemishes. Color as indicated on drawings.

2.4.2 Steel

Provide factory-applied finish/coating as indicated.

2.4.2.1 Fluoropolymer Coating

Exposed surfaces of steel louvers and flashing systems shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.005 to 0.008 mm (0.20 to 0.030 mils) and a color coat of minimum 0.025 mm (1.0 mils), total dry film thickness of 0.030 to 0.033 mm (1.2 to 1.3 mils). Finish shall be free of scratches and other blemishes. The system shall require no scheduled recoating to maintain its performance or for UV resistance. Color as indicated on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations. Locate and place louvers plumb, level and in proper alignment with adjacent work.

3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts. Screens shall be installed on the interior face of all louvers.

3.1.3 Fastening and Sealing

Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection. Form tight joints with exposed connections accurately fit together. Provide reveals and openings for sealants and joint fillers. Provide concealed gaskets flashing and joint fillers. Install as the work progresses to make the installation weathertight.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.2.4 Wood

Paint wood or other absorptive materials that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.3 REPAIRS

Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes and prime coat of paint so that there is not evidence of corrective work. Return items that cannot be refinished in the field to the shop to make the required alterations and refinish the entire unit.

3.4 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

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SECTION 10260

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(2003) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D 256	(2002e1) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D 543	(1995; R 2001) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(2003) Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM G 21	(1996; R 2002) Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G 22	(1976; R 1996) Determining Resistance of Plastics to Bacteria

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards; G
Wall Guards (Bumper Guards); G

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-03 Product Data

Corner Guards; G
Wall Guards (Bumper Guards); G

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Samples

Finish; G

Submit samples indicating color and texture of materials requiring color and finish.

SD-06 Test Reports

Corner Guards; G
Wall Guards (Bumper Guards); G

Fire rating and extinguishing test results for resilient material.

SD-07 Certificates

Corner Guards;
Wall Guards (Bumper Guards);

Statements attesting that the items comply with specified fire and safety code requirements.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C for at least 48 hours prior to installation.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a 1 year period shall be provided.

1.5 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of wall and corner protection with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 GENERAL

To the maximum extent possible, corner guards and wall guards (bumper guards), shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960 N.m/m when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other

combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.5 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21 or ASTM G 22, as applicable.

2.2 CORNER GUARDS

2.2.1 Clear Polycarbonate Resin Corner Guards

Corner guard units shall be surface mounted type, 90 degree square corner. Corner guards shall be 600 mm high and extend 38mm each side of corner. Mounting hardware, cushions, and base plates shall be furnished. Attachment shall be according to manufacturer's recommendations. Impact resistance shall conform to requirements of ASTM D 256.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 1.5 mm thick material conforming to ASTM A 167, type 302 or 304. Corner guards shall be 900 mm high and extend at least 38 mm each side of corner.

2.3 FINISH

2.3.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF-45. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating. Concealed aluminum shall be mill finish as fabricated, uniform in natural color and free from surface blemishes.

2.3.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A 167, Type 302, finish number 4.

2.4 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.5 COLOR

Color shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Stainless Steel Guards

a. Mount guards on external corners of interior walls, partitions and columns as per manufacturer's recommendations.

b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards per manufacturer's recommendations. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards shall overlap finish plaster surfaces.

(1) Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards to existing walls with 6 mm oval head stainless steel countersunk expansion or toggle bolts. Grout spaces solid between guards and backing with portland cement and sand mortar.

(2) Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

-- End of Section --

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SECTION 10430

EXTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(2003) Designation System for Aluminum Finishes

AMERICAN WELDING SOCIETY (AWS)

AWS C1.1M/C1.1	(2000)Resistance Welding
AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel
AWS D1.2	(2003) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 108	(2003a) Aluminum-Alloy Permanent Mold Castings
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM	(1988)Metal Finishes Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1190	Uniform Federal Accessibility Standards (UFAS)
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) for Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G,

Drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Exterior Signage Systems; G

Manufacturer's descriptive data and catalog cuts.

Installation

Manufacturer's installation instructions and cleaning instructions.

Exterior Signage Schedule; G,

Exterior signage schedule in electronic media with spread sheet format. Spread sheet shall include sign location, sign type, and

message.

Wind Load Requirements

Design analysis and supporting calculations performed in support of specified signage.

SD-04 Samples

Exterior Signage; G

Samples of each type of sign. Each sample shall consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Color samples for each material requiring color and 305 mm square sample of sign face color sample.

SD-10 Operation and Maintenance Data

Protection and Cleaning

Copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the equipment as installed.

1.3 GENERAL

To the greatest extent possible exterior signage shall be provided by a single manufacturer. Exterior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated or specified. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

1.4 WIND LOAD REQUIREMENTS

Exterior signage shall be designed to withstand windload caused by 137 km/h design wind speed.

1.5 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers on indicated signs for accessible buildings shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted.

1.6 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a

manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.7 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area in accordance with manufacturer's instructions.

1.8 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of exterior signage with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Signage is protected until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 LED DISPLAY READERBOARD SIGN

Freestanding electronic readerboard sign used to identify building and provide message text.

2.1.1 Display Cabinet

Readerboard shall have two self-contained heavy gauge formed aluminum LED Display cabinets serviceable from the front. Cabinets shall be weather resistant to meet NEMA 4X construction. Electronic readerboard shall contain a matrix of 32 x 160 pixels with one LED per pixel. LED cabinet shall be 832mm high by 3048mm wide at a minimum and capable of displaying the following number of rows and nominal sizes of alphanumeric characters: 2 rows of 254mm; 13 ~ 17 characters per row.

2.1.2 Readerboard Central Processing Unit (CPU)

The readerboard shall contain a Central Processing Unit with a

microprocessor based circuit board assembly. The unit shall be a 10MHz device with a minimum of 2-MB batter backed static RAM memory and 128K bytes Flash ROM with on board programmability. The input/output shall be (1) RS-232, RS-485/422 serial port jumper.

2.1.3 Software Requirements

The readerboard shall be capable of being scheduled in 12 or 24 hour formats. The scheduler shall reside within the display cabinet as an onboard processor. Software shall have password protection capability. All operating software shall be provided to Contracting Officer along with required usage licenses and software updates.

2.1.4 Electrical Requirements

A separate power supply shall be provided for the CPU and LED power supplies as shown on the drawings.

2.1.5 Information Transfer

Readerboard shall be compatible with the following transmission methods: telephone modem, LAN connection using CAT6 cable, direct laptop PC connection. Communication to the Readerboard shall be over CAT6 cable through conduit as shown on plans.

2.1.6 Support Structure

Entire readerboard and footing shall be engineered to withstand 120 mph, Exposure B. Cast-in place concrete engineered footing shall be designed to meet support and wind loads.

2.1.7 Test Procedures

Readerboard shall be tested per manufacturer's instructions prior to Government acceptance of work.

2.1.8 Operation and Maintenance Manual

Six copies of the Manufacturer's Operation and Maintenance Manuals shall be provided. Manuals shall include all information required to ensure User can fully operate the Readerboard.

2.2 EXTERIOR SIGNAGE SYSTEMS

Exterior signage shall consist of a system of coordinated directional, identification, and regulatory type signs located where shown. Dimensions, details, materials, message content, and design of signage shall be as shown. Signage schemes shall match materials, styles and colors utilized on North Fort Lewis.

2.2.1 Panel And Post/Panel Type Signs

2.2.1.1 Posts

One-piece aluminum posts shall be provided as detailed. Posts shall be designed to accept panel framing system described. The post shall be designed to permit attachment of panel framing system without exposed fasteners. Caps shall be provided for each post.

2.2.1.2 Panel Framing System

Panel framing consisting of aluminum sections and interlocking track components shall be designed to interlock with posts with concealed fasteners.

2.2.1.3 Panels

Modular message panels shall be provided in sizes shown on drawings. Panels shall be fabricated of minimum 3.0 mm thick aluminum. Panels shall be designed to be interchangeable. Panels with metal return sheeting shall have welded corners, ground smooth.

2.2.1.4 Finishes

Post finish shall be anodized conforming to AA DAF-45. Metal panel system finish shall be baked enamel or two-component acrylic polyurethane.

2.2.1.5 Mounting

Permanent mounting shall be provided by embedding posts in concrete foundation as shown. Removable mounting shall be provided by an aluminum sleeve embedded in concrete as shown.

2.2.2 Building Mounted Panel Signs

Building mounted panel signage shall be fabricated of materials as specified for Panel and Post signs and adhesive bonded to a backer panel of 6 mm thick clear acrylic sheet. Attachment to masonry walls shall be with drilled, sleeve type, masonry anchors.

2.2.3 Room Identification Signs

Wall mounted signage used to identify rooms or areas that are accessed only from the exterior shall be provided as specified in SECTION 10440 INTERIOR SIGNAGE. Use melamine plastic type resistant to general weathering and ultraviolet exposure.

2.2.4 Building Number Signs

2.2.4.1 Fabrication

Building number signs shall have black vinyl letters on a white reflective vinyl background mounted on 28 gauge galvanized steel. Steel sheet shall be adhesive bonded to a backer panel of 6 mm thick clear acrylic sheet. Size shall be as indicated. Building number shall be provided/verified by Contracting Officer's Representative.

2.2.4.2 Typeface

Typeface shall be Helvetica medium, size as indicated.

2.2.4.3 Mounting

Threaded studs of number and size as recommended by manufacturer, shall be used for concealed anchorage. Mount a total of four signs on each building. Signs on both sides of opposing corners. Select corner pairs to maximize visibility from adjacent streets.

2.3 ILLUMINATION

External sign lighting shall be provided as indicated and as specified in SECTION 16528 EXTERIOR LIGHTING INCLUDING SECURITY AND CCTV APPLICATIONS. Lighting shall be controlled by a photocell device. Electrical equipment shall be UL or FM listed and comply with NFPA 70. Illumination shall be evenly distributed.

2.4 GRAPHICS FOR EXTERIOR SIGNAGE SYSTEMS

2.4.1 Graphics

Signage graphics shall conform to the following:

a. Pressure sensitive precision cut vinyl letters with reflecting surface shall be provided.

b. Message shall be applied using the frisket method. Photomechanically reproduced graphic masks shall be applied to the sign face which has been coated with the graphics color. A background shall then be applied to the exposed surfaces. Handcut masks will not be accepted. Edges that are nicked, cut, or ragged will not be acceptable. A protective overcoat containing UV-resistant additives shall be applied.

2.4.2 Messages

See drawings for message content. Typeface: Helvetica medium. Type size as indicated.

2.5 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209M for sheet or plate, ASTM B 221M for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings. Aluminum extrusions shall be provided at least 3 mm thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products shall conform to AWS C1.1M/C1.1.

2.6 ANODIC COATING

Anodized finish shall conform to AA DAF-45 as follows:

Clear (natural) designation AA-M10-C22-A31, Architectural Class II 0.010 mm or thicker.

Integrated color anodized designation AA-M10-C22-A32, Architectural Class 0.010 to 0.018 mm.

Electrolytically deposited color - anodized designation AA-M10-C22-A34, Architectural Class II 0.010 to 0.018 mm.

2.7 ORGANIC COATING

Surfaces shall be cleaned, primed, and given a semi-gloss baked enamel or two-component acrylic polyurethane finish in accordance with NAAMM MFM, AMP 505, with total dry film thickness not less than 0.030 mm .

2.8 STEEL PRODUCTS

Structural steel products shall conform to ASTM A 36/A 36M. Sheet and strip steel products shall conform to ASTM A 570/A 570M. Welding for steel products shall conform to AWS D1.2.

2.9 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting shall be 5 to 7 year premium type and shall be in accordance with the flammability requirements of ASTM E 84 and shall be a minimum 0.08 mm film thickness. Film shall include a precoated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

2.10 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish and shall be non-rusting, non-corroding, and non-staining. Exposed fasteners shall be tamper-proof.

2.11 SHOP FABRICATION AND MANUFACTURE

2.11.1 Factory Workmanship

Work shall be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practical. Items specified to be galvanized shall be by hot-dip process after fabrication if practical. Galvanization shall be in accordance with ASTM A 123/A 123M and ASTM A 653/A 653M, as applicable. Other metallic coatings of steel sheet shall be in accordance with ASTM A 924/A 924M. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

2.11.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

2.11.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, shall be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete shall not be painted. Upon completion of work, damaged surfaces shall be recoated.

2.12 COLOR, FINISH, AND CONTRAST

Colors shall be as indicated on the drawings. Colors not indicated shall be selected from full range of manufacturer's standard colors. Colors listed are not intended to limit the selection of equal colors from other manufacturers. For buildings required to be accessible, and signage at accessible site features, signs shall meet the requirements of 36 CFR 1190 and 36 CFR 1191. Characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs, plaques, and dimensional letters shall be installed in accordance with approved manufacturer's instructions at locations shown on the approved detail drawings. Electrical circuits installed underground shall conform to the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Steel conduits installed underground shall be in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

3.1.1 Anchorage

Anchorage and fastener materials shall be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, the Contractor shall cover all project identification, directional, and other signs which may mislead the public. Covering shall be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Signs shall be cleaned, as required, at time of cover removal.

3.2 FIELD PAINTED FINISH

Miscellaneous metals and frames shall be field painted in accordance with Section 09900 PAINTS AND COATINGS. Anodized metals, masonry, and glass shall be protected from paint. Finish shall be free of scratches or other blemishes.

-- End of Section --

SECTION 10440

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(2003) Designation System for Aluminum Finishes
AA PK-1	(2002) Pink Sheets: Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605	(1998) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1994) Safety Glazing Materials Used in Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2	(2003) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1190	Uniform Federal Accessibility Standards

(UFAS)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) for Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message (with room numbers) shall be included.

SD-03 Product Data

Installation; G

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage; G

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Directional sign.

b. Door identification sign.

c. Occupant identification sign (removable message strips).

d. Sustainable information signs.

e. Casework signs.

Samples of manufacturer's standard color chips for each material requiring color selection.

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions;G
Protection and Cleaning;

Operating instructions outlining the step-by-step procedures required for system operation shall be provided. The instructions shall include simplified diagrams for the system as installed. Copies of maintenance instructions listing routine procedures, repairs, and guides shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings or in the specifications, shall conform to the requirements specified, and shall be provided at every room and at other locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Signs shall conform to the requirements of 36 CFR 1190 and 36 CFR 1191.

1.3.1 Character Proportions and Heights

Letters and numbers on all signs which do not designate permanent rooms or spaces, shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted. Suspended or projected overhead signs shall have a minimum character height of 75 mm.

1.3.2 Raised and Braille Characters and Pictorial Symbol Signs (Pictograms)

Letters and numbers on signs which designate permanent rooms and spaces shall be raised 0.8 mm upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 16 mm in height, but no higher than 50 mm. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 152 mm minimum in height. Indicated accessible facilities shall use the international symbol of accessibility.

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 EXTRA STOCK

The Contractor shall provide 5 extra frames and extra stock of the following: 100 changeable message strips for signs with message strip windows.

1.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of interior signage with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Conduct pre-manufacturing conference to review shop drawings and samples with government and user.

(3) Inspection of material delivered to the project site against approved material data.

(4) Protection of signage until occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

Signs shall be a modular system, using high impact, integrally colored injection molded holder frames and sign inserts fabricated of thermosetting melamine plastic (Type MP) or acrylic plastic conforming to ANSI Z97.1. Wall mounted signs shall be square, minimum 180 mm by 180 mm in size and feature radius frame corners. Text shall be of consistent type and size on all signs.

2.1.1 Standard Room Signs

Signs (frames and inserts) shall consist of matte finished plastic surface. Corners of signs shall be radius type standard with the manufacturer. Text shall include room number and name as scheduled. Signs at conference rooms shall include a permanent changeable horizontal sliding sign indicating "open"/"in use".

2.1.2 Changeable Message Strip Signs

Changeable message strip signs shall consist of cast acrylic or laminated thermosetting Type MP plastic matching standard room signs. In addition, provide plastic captive message strip clear faced message slots with associated end caps, as detailed, for insertion of changeable message strips. Number of slots shall be one or two as indicated. Signs shall be square, minimum 180 mm by 180 mm in size. Individual message strips to permit removal, change, and reinsertion shall be provided as detailed. Corners of signs shall be radius type.

2.1.3 Pictogram Signs

Pictogram signs shall match size and materials of Standard Room Signs. Provide pictograms of international symbology as required by ADAAG. Areas with pictograms shall include toilet rooms, accessible exits, and public phones.

2.1.4 Type of Mounting For Signs

Extruded aluminum brackets, mounted as shown, shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be provided with countersunk mounting holes in plaques/frames and mounting screws. Sign inserts shall be provided with 1.6 mm thick foam tape or manufacturer's standard removable insert system.

2.1.5 Graphics

Signage graphics for modular identification/directional signs shall conform to the following:

2.1.5.1 Signs not at Permanent Rooms

Pressure sensitive prespaced and prealigned precision computer cut vinyl letters on release paper shall be provided. Edges and corners of finished letter forms and graphics shall be true and clean. Vinyl sheeting for graphics shall be 5 to 7 year premium type and shall be a minimum 0.08 mm film thickness. Film shall include a precoated pressure sensitive adhesive backing.

Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art shall be defined as artwork that is a first generation reproduction of the specified art. Edges and corners shall be clean.

2.1.5.2 Signs at Permanent Rooms

Graphics shall be raised 0.8 mm with background of exposed contrasting color material.

2.1.6 Sustainable Information Signs

Message shall be reverse engraved on a 2-ply, 1.3 mm thick microsurfaced impact acrylic. The sign shall have a nonglare, matte finish with colors specified on the drawings. The sign shall be 300 mm wide x 500 mm tall. Edges of sign shall be true and clean with no frame. Signs shall be mounted using manufacturer approved clear adhesive backing. Signs shall be mounted with vertical center at 1520 mm above finished floor. Signs shall be wall mounted in North and South Lobbies and on the wall adjacent to specific features and systems as indicated.

2.1.6.1 Sustainable Information Sign Content

Sustainable design features of each building shall be listed. The title of the sign shall be "Sustainable Design Features of North Fort Chapel". Title letters shall be 25 mm tall, helvetica medium typeface. The listed sustainable design feature information letters shall be 10 mm tall, helvetica medium typeface. Suggested information will vary with construction put in place. Suggested areas include: Local and regional materials use, High efficiency mechanical, electrical, and plumbing systems; Operable windows for natural ventilation, Soybean oil in spray foam insulation; Captured rainwater for toilet flushing and irrigation, Cabinetry made from agrifiber board, Non-toxic paint, adhesives, carpet, and wood finishes, Carpet, ceramic tile, and rubber tile flooring with recycled content; and Wood from sustainably harvested forests.

2.1.7 Casework Signs

Message shall be reverse engraved on a 2-ply, 1.3 mm thick microsurfaced impact acrylic. The sign shall have a nonglare, matte finish with colors specified on the drawings. The sign shall be 100 mm wide x 50 mm tall. Edges of sign shall be true and clean with no frame. Signs shall be mounted using manufacturer approved clear adhesive backing. Signs shall be mounted in the upper right corner of the center bottom cabinet and/or drawers for casework and the upper right corner for display cases. Sign verbage shall read: "Casework made from agrifiber board, a recycled agricultural by-product." Lettering shall be 6 mm tall, Helvetica Medium typeface.

2.2 BUILDING DIRECTORIES

Building directory shall be located in South Lobby as indicated and shall be provided with a changeable directory listing consisting of the areas, offices and personnel by generic title)located within the facility. Dimensions, details, and materials of sign shall be as shown on the drawings. Where required, message content shall be as shown on drawings and schedule. Directories shall be consistent with the signage system used for room identification and directional signage.

2.2.1 Header Panel

Header panel shall be acrylic with raised acrylic letters or MP plastic with raised letters consistent with Room Identification signage.

2.2.2 Cover

2.2.2.1 Cover Glazing

Protective cover glazing shall be clear acrylic sheet 4.8 mm thick or clear polycarbonate sheet 4.8 mm thick with self locking, easy release design.

2.2.3 Construction

Plastic frames and trim shall be assembled of same materials as room signage with no exposed fasteners. Internal frame shall provide for concealed mounting of directory to wall surfaces.

2.2.4 Changeable Letter/Message Strip Directory System

Directory shall consist of a non-illuminated unit with step, groove, or stacking frame to receive molded, changeable message strips with silkscreened or vinyl letters. Design of unit shall provide single or double column stacking of strips as required by the number of strips indicated.

2.2.4.1 Message Strips

Message strips shall be updatable by user with coupon book reordering and with 5 to 7 day delivery. Message strips shall be acrylic sized per manufacturer's standard, but not smaller than 13 mm high. Provide a minimum of 12 strips.

2.3 Emergency Plan Sign

Provide emergency plan signs as indicated for the facility. Signs shall be located in North, South and West Lobbies. Construction shall match directory signs specified. Permanent opaque header panel shall indicate "Emergency Plan". Remainder of sign shall have a clear plastic window and be designed for the insertion of a paper, schematic floor plan drawing. Provide drawings for each building with pertinent emergency/exiting information customized for the location of each sign. Minimum overall size of sign shall be 300 mm by 300 mm.

2.4 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions shall be at least 3 mm thick, and aluminum plate or sheet shall be at least 1.3 mm thick. Extrusions shall conform to ASTM B 221M ; plate and sheet shall conform to ASTM B 209M . Where anodic coatings are specified, alloy shall conform to AA PK-1 alloy designation 514.0. Exposed anodized aluminum finishes shall be as shown. Welding for aluminum products shall conform to AWS D1.2.

2.5 ANODIC COATING

Anodized finish shall conform to AA DAF-45 as follows:

Integral color anodized designation AA-M10-C22-A32, Architectural Class

0.010 to 0.018 mm or,

Electrolytically deposited color-anodized designation AA-M10-C22-A34, Architectural Class II 0.010 to 0.018 mm.

2.6 ORGANIC COATING

Organic coating shall conform to AAMA 605, with total dry film thickness not less than 0.030 mm.

2.7 FABRICATION AND MANUFACTURE

2.7.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.7.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

2.8 COLOR, FINISH, AND CONTRAST

Color shall be as indicated on drawings. Consistent with ADAAG requirements, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

2.9 PRESSURE SENSITIVE LETTERS

Ensure that edges and corners of finished letterforms and graphics are true and clean. Do not use letterforms and graphics with rounded positive or negative corners, nicked, cut, or ragged edges.

2.9.1 Typeface

Helvetica medium.

2.9.2 Size

As indicated.

2.9.3 Color

As indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Where no mounting location is indicated, follow ADAAG requirements. Required blocking shall be installed as detailed. Signs which designate permanent rooms and spaces shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 75 mm of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 2 mm thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 0.13 mm green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations. Signs mounted to painted gypsum board surfaces shall be removable for painting maintenance. Signs mounted to lay-in ceiling grids shall be mounted with clip connections to ceiling tees.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

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SECTION 10520

FIRE EXTINGUISHER CABINETS AND ACCESSORIES

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

FIRE EXTINGUISHER CABINETS; G

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-03 Product Data

FIRE EXTINGUISHER CABINETS; G

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-07 Certificates

FIRE EXTINGUISHER CABINETS; G

For cabinets that penetrate fire rated wall construction, provide certification attesting that the items comply with specified fire and safety code requirements to maintain fire rating of wall.

1.2 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover.

1.3 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

1.4 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of exterior brick veneer wall construction with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Sheet Steel

Cold-rolled, annealed, stretcher leveled, bonderized or equivalent treatment and cleaned for the finish specified.

2.1.2 Glass

Glazing shall be double strength wire glass or laminated glass standard to the manufacturer.

2.2 FIRE EXTINGUISHER CABINETS

2.2.1 General

Fire extinguisher cabinets shall be semi-recessed type with square trim. Use surface mounted type only at locations where thickness of wall or adjacent structural components make a semi-recessed installation impossible. Cabinets shall be manufacturer's standard size as required to house a 9.5 liter, pressurized water type extinguisher. For number, type and location of cabinets and wall recesses required, see drawings. Extinguishers will be provided by the government.

2.2.2 Body Construction

Body shall be sheet steel not less than 0.9 mm (20 gauge), one piece full-welded, with square corners or a seamless front, full-welded to back and at corners. Welds shall be continuous in full depth and width, and dressed smooth on all exposed surfaces. Sides shall be cut, punched or drilled as necessary to receive hardware.

2.2.3 Door Construction

Door shall be hollow construction sheet steel not less than 0.9 mm (20 gauge). Rails and stiles of one-piece rolled section, mitered and welded at corners. Provide glass retainers on inside for glass panel covering at least 75 percent of total door area.

2.2.4 Fabrication

All welds shall be ground smooth. All irregularities in finished surfaces from welding, cutting, punching or drilling shall be dressed smooth prior to painting. All foreign matter shall be removed from finished cabinet prior to painting.

2.2.5 Painting

After cleaning prime concealed and exposed metal surfaces with one coat of baked flat white enamel. Exposed interior surfaces, in addition to the prime coat, shall receive not less than two coats of white baked enamel finish. Exposed exterior surfaces, in addition to the prime coat, shall receive not less than two coats of red baked enamel finish.

2.2.6 Hardware

All cabinets shall be provided with continuous piano hinge (minimum 100 degree opening), pull handle and cam action latch. Handle shall be chromium, satin finish. Keyed locks are not required.

PART 3 EXECUTION

3.1 INSTALLATION

Provide two anchors on each jamb, spaced not more than 610 mm apart and adjustable. Anchors shall be a minimum of 50 mm wide, extend 200 mm into masonry, or 75 mm into concrete, or consist of direct bolting at steel framing. Where cabinet is located in a rated wall, provide manufacturer's fire rated cabinet or a gypsum wallboard surround system to maintain rated integrity of wall. Number, location and mounting height of fire extinguisher cabinets shall meet requirements of NFPA 10 and NFPA 101. Size recess openings such that cabinet front completely covers rough opening. Provide sealant at all seams between cabinets and wall surface.

-- End of Section --

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SECTION 10650

OPERABLE PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 336	(1997e1) Measurement of Airborne Sound Insulation in Buildings
ASTM E 413	(1987; R 1999) Rating Sound Insulation
ASTM E 557	(2000) Installation of Operable Partitions
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
NFPA 101	(2003) Life Safety Code

1.2 GENERAL REQUIREMENTS

The Contractor shall supply and install electric operation, continuously hinged, flat wall, acoustical operable partitions, factory finished, supported from overhead track without floor guides, as shown on the drawings including all operating hardware, seals, track and rollers and electrical power and control devices as needed to provide a complete functional operable partition system to close the specified opening. This operable partition specification covers wall panel partitions located in the Worship and Activity rooms. See Section 10655 Accordion Folding Partitions for classroom divider partitions.

1.2.1 Electric Operation

Provide automatic safety shut off device using either pressure sensitive leading edge, or infra-red detection device. The pressure-sensitive leading edge shall be designed so that a 17.8 N force will stop the forward

motion. Infra-red detection device shall observe an open zone around moving partitions. Safety system shall stop the partition movement if people or objects are in the path of the partition when it is being extended or in the pocket area when the panels are being stacked. Weight-sensitive floor mat in the storage pocket shall prevent partition movement with as little as 2.3 kg of weight applied. The electric control shall be wall mounted.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Procedure; G
Wiring Diagrams; G
Layouts; G

Drawings containing complete schematic diagrams and details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show dimensions and weight of stacked partition; layout of the work including door pockets, track and jamb fastening methods; seal details and installation details; proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation. Submit wiring diagram and installation details for electrical operator.

SD-03 Product Data

Operable Partitions; G

Manufacturer's descriptive data, performance charts, catalog cuts, and installation instructions for framework, suspension system, covering, accessories, and electrical operators.

SD-04 Samples

Operable Partitions; G

Color samples of indicated surfaces and finishes to match those specified. Finish and color requirements shall not be limited to manufacturer's standard selections in order to meet these requirements. Color samples of all exposed trim and hardware items.

Full range of color, pattern, fabrics and trim available; G

SD-06 Test Reports

Acoustical Test; G
Flame and Smoke Development Tests; G

Reports on laboratory acoustical requirements and acoustical field test. Reports on flame and smoke development tests.

SD-07 Certificates

Materials; G
Operable Partitions; G

Certificate attesting that the materials meet the requirements specified and that partitions have specified acoustical and flame retardant properties, as determined by test.

SD-10 Operation and Maintenance Data

Operable Partitions

Provide complete copies of operating instructions outlining the procedures required for electrically operated partitions. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and operating features. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Provide complete copies of maintenance instructions explaining routine maintenance procedures including inspection, adjustments, lubrication, and cleaning. The instructions shall list possible breakdown, methods of repair, and a troubleshooting guide. The instructions shall include equipment layout and simplified wiring and control diagrams of the system as installed.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in the manufacturer's original, unopened, and undamaged packages with labels legible and intact. Provide labels to indicate the manufacturer, brand name, size, finish, and placement location. Store partitions and accessories in unopened packages in a manner that will prevent damage. Handle partition materials in accordance with manufacturer's instructions. Materials shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided. In addition, the pantographs, trolleys and tracks shall be guaranteed for 10 years from date of acceptance for beneficial use.

1.6 QUALITY ASSURANCE

Operable partition installer shall be certified and approved by the partition manufacturer. Do not remove partition components from packaging prior to the start of installation. Verify that all required structural framing is in place and complete prior to starting installation.

PART 2 PRODUCTS

2.1 MATERIALS

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 year prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Provide heavy-duty type hardware standard with the manufacturer. Provide pulls and latches for all partitions. Provide partitions with keyed locks. Hardware shall be dark bronze anodized aluminum finish.

2.2 OPERABLE WALL PANEL PARTITIONS

Operable wall panel partitions shall consist of top hung ball bearing carriers which support modular panels.

a. Provide partitions made up of a series of rigid panels, each panel being a one-piece assembly. Unless otherwise specified, the wall shall comprise the least number of panels. The mechanical seal of the panel shall actuate with a single operating action.

b. Provide continuously hinged panel type as indicated.

2.2.1 Panels

Provide panels of steel skin, laminated to appropriate structural acoustical backing, mounted in full perimeter protective frame. Panel frames shall be a minimum of 16 ga formed steel with minimum 21 ga face panels wrapped around panel edge, and welded to the frame to form unitized construction. Frame shall enclose and protect all edges of the surface material. Panels shall be not more than 1200 mm wide, except for end closure panels, and shall be full height to track. Overall panel thickness shall be approximately 85 mm. Panels shall lock in place to form a stable, rigid partition; low profile hinges shall project no more than 6 mm maximum from panel edge. Panel surfacing shall wrap around the vertical panel edges without vertical trim.

2.2.2 Finish Covering

Finish material shall span the full panel width and height as an uninterrupted sheet. Covering fabric shall be wall covering and upholstery fabric weighing not less than 12 ounces per square yard. Woven fabric shall be 100% polyolefin, shall not support mildew or bacterial growth, and have low static performance. Backing shall be acrylic latex type. Class "A" rated, passing corner burn test (NFPA 265 and UBC 8-2), meeting

vertical burn requirements of ANSI A-17. Wall covering fabric shall be treated with stain resistant fabric protectant. Tensile strength as tested by ASTM D-1682 shall be at least 70 kgs in warp and filling. Tear strength as tested by ASTM D-2261 of at least 13 kgs across warp and 7 kgs across filling. Color fastness to light by AATCC 16 A of Class 5. Fabric shall be non-allergenic.

2.2.3 Track

Track shall be recessed as shown and shall be of minimum 7 ga steel. Track shall be manufacturer's standard product designed for the weight of the finished partition, including accessory items. Track sections shall be provided in the maximum lengths practicable, not less than 1800 mm long except for ends of runs where short length is required. Suitable joint devices such as interlocking keys shall be provided at each joint to provide permanent alignment of track. Removeable track soffit shall be steel, anchored to track brackets and finish painted.

2.2.4 Suspension System

Provide a suspension system consisting of steel track connected to the structural support by threaded rods, and trolleys designed to support the weight of the partition. Provide center hung panel with 1 trolley with four or eight steel tired, ball bearing wheels per panel.

2.3 ACCESSORIES

2.3.1 Ceiling Guards

Furnish partitions with ceiling guards or integral track and ceiling guards as indicated and as recommended by the manufacturer.

2.3.2 Metal Soffit

Soffit shall be provided when steel track is recessed. Soffit shall be of metal of adequate thickness to protect the ceiling from damage by door operation and shall be provided with the door manufacturer's standard neutral-color applied finish. Soffit on aluminum track shall be an integral part of the track

2.4 SEALS AND SWEEPSTRIPS

Provide perimeter seals and sound insulation, of manufacturer's standard product, to achieve the sound transmission class specified and to pass the visual field test specified, without crack or craze when subjected to severe usage. Provide manufacturer's vertical seals between panels to ensure acoustical rating. Vertical seal between panels shall be interlocking steel astragals, mounted on edges of both meeting panels. Top seals shall consist of vinyl sweep mechanical seal and bulb type seals which expand in place. Bottom seal shall be accomplished by using panels which have an automatic floor seal device integrated with the door deployment sequence. Automatic seals shall provide at least 30 mm of clearance when doors are in motion. Sweep strips shall be vinyl or other material which will not crack or craze with severe usage. Sweep strips

shall control STC to the specified rating. Meeting style between partition halves shall have a device to mechanically latch the halves together for security.

2.5 ELECTRICAL OPERATORS

2.5.1 Motor

Provide manufacturer's recommended standard electrical operator for each partition. Electric motors shall be 208-volt, 3-phase, 1-horsepower, 60 hertz. Provide wiring diagrams. Drive unit motor shall use a chain drive to pull the partition into position. Cable, belt and similar friction drives are not acceptable. Motors shall be equipped with limit switches to prevent over-extension. Fully adjustable clutch type overload devices are also required.

2.5.2 Controls

Each partition half segment (4 total) shall be operated by two keyed control stations located on opposite sides of the partition. Control sequence shall permit operation of any partition segment independently of the others. Control stations shall have basic operating instructions permanently stamped into faceplate. Design of key actuated controls shall permit complete lock out of unauthorized users.

2.5.3 Safety Devices

Safety devices are discussed in paragraph 1.2.1. Safety devices shall halt door motion based on contact or proximity and shall signal an audible alarm.

2.6 POCKET DOORS

2.6.1 Door Panel

Storage pocket door panels shall be of the same construction (steel skin and frame) and surface finish as the partition panels. Hinges shall be full leaf butt type attached to panel frame and structural channel steel jamb framing. Configure jamb and hinge attachment such that doors have 180 degree swing. Provide welded hinge anchor plates at panel and jamb. Door panel weight maximum shall be 44 kg/square meter. Doors shall have same acoustical properties and components as required for partition panels.

2.6.2 Door Function

Doors shall be manual operation and form a door pair hinged separately to each jamb. Doors shall close to the center of the pocket when the partition is extended. One door of the pair shall have a smaller full height leaf, hinged to the strike edge of the door, that permits the door pair to completely close off the door pocket when the partition is in the stacked/stored position. Configuration of doors shall provide for full closure of storage pocket whether partition is extended or retracted.

2.6.3 Door Hardware

Each door leaf shall be provided with a recessed hand pull. Each door leaf shall be provided with a footbolt to secure the door panel at the floor. Coordinate requirement for installation of footbolt receptor with floor construction. Handpulls and footbolts shall be finished to match other panel accessories.

2.7 PERFORMANCE REQUIREMENTS

2.7.1 Fire Endurance

For partitions more than 5.6 square meters in area, provide covering and lining with flame spread rating of 25 or less, fuel contribution rating of 15 or less, smoke generation of 50 or less in accordance with NFPA 101 when tested in accordance with ASTM E 84. The Contractor shall submit flame and smoke development test reports. Door and partition finishes shall have a Class A rating when tested in accordance with ASTM E 84.

2.7.2 Laboratory Acoustical Requirements

Partitions shall have been tested in accordance with ASTM E 90 by a laboratory accredited by the U.S. Bureau of Standards and have attained a sound transmission class (STC) of not less than 45 in a fully extended position, with a Noise Reduction Coefficient (NRC) of 0.25-0.30 for napped, tufted or looped fabric. Partition tested shall be of the same construction, materials, and model number as the partition to be provided and shall be fully operable. Test specimen shall be not less than 12 square meters in area. Panel weight shall be a minimum of 36 kg/square meter for STC of 45. If higher STC value is provided panel weight shall be at least 41 kg/ square meter for STC up to 50 and 48 kg/square meter for STC up to 53. Panel thickness (85 mm nominal) and composition shall be designed to provide the required STC rating in accordance with ASTM E 90 and ASTM E 413.

2.8 COLOR

Color and pattern of surface finishes shall be as indicated on the drawings or as selected from manufacturers full palette of standard colors and patterns, if an alternate manufacturer is selected. Colors/patterns indicated are not intended to limit selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's approved instructions, standard printed specifications and written project specific recommendations.

3.1.1 Preparation Work

Check openings scheduled to receive operable partitions for correct dimensions. Verify that all predecessor systems and materials are in place before beginning partition installation. Install partitions in accordance

with the approved partition layouts, manufacturer's directions, and ASTM E 557. Structural support for the track support elements shall be as indicated.

3.1.2 Electrical Operators

Conform electrical components and installation to the requirements of NFPA 70 and Section 16415 ELECTRICAL WORK, INTERIOR. Provide the partition manufacturer's standard drive and control components required to operate the partition as indicated and identified in the approved shop drawings. Power source is as indicated.

3.1.3 Adjustment

Adjust drive components and limit switches of electrically operated partitions to ensure the partitions operate properly upon activation of the control switch. Adjust all hinges and other operating hardware to ensure unrestricted motion free of unnatural noise.

3.2 FIELD TESTS

3.2.1 Operational Test

In the presence of the Contracting Officer, operate partition at least three times to demonstrate that partition is capable of being moved from the stored position to the fully extended position smoothly and quietly and without overloading the drive components. Activate the emergency release mechanism (if provided as a standard manufacturers component) and demonstrate proper operation of the partition in the manual mode. Demonstrate proper activation of mechanical seals at top and/or bottom of panels. Demonstrate proper contact and seal at meeting jamb between panel halves. Adjust partitions which do not operate properly and retest.

3.2.2 Visual Test

Conduct visual field tests for light leakage with all room lights turned on in the space on one side of the partition. Darken space on the other side of the partition. There shall be no light leakage from the lighted space to the darkened space. If light leakage does occur, adjust the partition to correct the problem and retest. This test shall be performed for both partitions independently.

3.2.3 Acoustical Test

Field sound performance: partition shall be tested by an independent certified acoustical consultant in accordance with ASTM E 336, and achieve a Noise Isolation Class (NIC) of 35 plus or minus two. Adjust and/or modify partitions which do not comply, and retest.

3.3 CLEANING

Clean any soiled parts of the partition in accordance with manufacturer's printed instructions. Partition parts/panels that cannot be cleaned to the satisfaction of the C.O.R. shall be replaced.

-- End of Section --

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SECTION 10655

ACCORDION FOLDING PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM E 336	(1997e1) Measurement of Airborne Sound Insulation in Buildings
ASTM E 557	(2000) Installation of Operable Partitions
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Partition layouts; G

Submit drawings for the system that include dimensions and weight of stacked partition, layout of the work, track and jamb fastening methods, hardware installation, seal details, and installation details. Provide plans, elevations and sections.

SD-03 Product Data

Framework

Suspension system

Covering

Installation and Operating Instructions

SD-04 Samples

Covering; G

Full range of color, pattern, fabrics and trim available; G

SD-06 Test Reports

Laboratory Acoustical Requirements; G

Acoustical test; G

SD-10 Operation and Maintenance Data

Folding partitions; G

1.3 GUARANTEE

Partitions shall be guaranteed against defects in material and workmanship for a period of two years from date of installation. In addition, the pantographs, trolleys and tracks shall be guaranteed for 10 years from date of acceptance for beneficial use.

1.4 DELIVERY, HANDLING AND STORAGE

Deliver materials to project site in manufacturer's original, unopened, and undamaged packages with labels legible and intact. Labels to indicate the manufacturer, brand name, size, finish, and placement location. Label coding system shall match that used on shop drawings. Store folding partitions and accessories in unopened packages in a manner that will prevent damage. Handle partition materials in accordance with manufacturer's instructions.

1.5 QUALITY ASSURANCE

Installer shall have at least 2 years experience with the systems used on this project and shall be certified qualified for the work by the partition manufacturer. Confirm that openings are ready for installation prior to removing partition components from packaging.

PART 2 PRODUCTS

2.1 FOLDING PARTITIONS

Provide full accordion type partitions, factory finished, supported from overhead track without floor guides, and complete with all hardware, track, and accessories necessary for operation. Provide partition framework with a mechanism that gives stability and maintains uniform spacing of partition folds in all partition positions. Provide completely concealed framework with a fabric covering. Provide manually operated, bi-parting, sound control partitions as indicated. Provide patterns and colors of fabric as indicated. Nominal profile shall be 230 mm.

2.2 MATERIALS

2.2.1 Aluminum Extrusions

ASTM B 221M, Alloy 3003.

2.2.2 Steel Sheets

ASTM A 653/A 653M.

2.2.3 Woven Fabric Covering

Woven fabric shall be 100% polyolefin, shall not support mildew or bacterial growth, and have low static performance. Backing shall be acrylic latex type. Class "A" rated, passing corner burn test (NFPA 265 and UBC 8-2), meeting vertical burn requirements of ANSI A-17. Wall covering fabric shall be treated with stain resistant, fabric protectant and minimum weight of 12 ounces per square yard. Tensile strength as tested by ASTM D-1682 shall be at least 70 kgs in warp and filling. Tear strength as tested by ASTM D-2261 of at least 13 kgs across warp and 7 kgs across filling. Color fastness to light by AATCC 16 A of Class 5.

2.2.4 Seals and Sweepstrips

Provide perimeter seals of manufacturer's standard product, without crack or craze when subjected to severe usage.

2.2.5 Ceiling Guards

Furnish partitions with ceiling guards or integral track and ceiling guards as recommended by the manufacturer and consistent with detailing indicated on drawings.

2.3 PERFORMANCE REQUIREMENTS

2.3.1 Fire Endurance

For partitions more than 5.6 square meters in area, provide fabric and lining with flame spread rating of 25 or less, fuel contribution rating of 15 or less, smoke generation of 50 or less when tested in accordance with ASTM E 84.

2.3.2 Laboratory Acoustical Requirements

Folding partitions shall have been tested in accordance with ASTM E 90 by a

laboratory accredited by the U.S. Bureau of Standards and have attained a sound transmission class (STC) of not less than 39 in a fully extended position. Partition tested shall be of the same construction, materials, and model number as the partition to be provided and shall be fully operable. Test specimen shall be not less than 12 square meters in area. Panel weight shall be 14 kg per square meter.

2.4 FABRICATION

2.4.1 Framework

Fabricate framework, including posts, pantographs, hinges, hinge plates, and rods from either extruded aluminum or ferrous metal. Arrange frames requiring pantographs for horizontal pantograph action with pantographs located at top and bottom of the frame. Provide pantographs spaced not over 1200 mm apart. Provide intermediate pantograph at center of doors less than 2400 mm high unless the door has vertical metal reinforcing. The pantographs shall operate smoothly with positive folding action and shall have a control device to prevent flattening of the folds when the panel is fully extended. Ferrous metal shall be either cadmium plated or zinc coated, except posts at the option of the door manufacturer shall have phosphate treatment and manufacturer's shop finish paint.

2.4.2 Suspension System

Provide a suspension system consisting of steel or aluminum track and trolleys designed to support the weight of the partition. Provide steel track of 1.5 mm minimum, phosphate treated and finished, or zinc or cadmium coated. Provide extruded aluminum track with minimum thickness of 3 mm. Tracks shall have an integral ceiling guard, consistent with the adjacent ceiling material. Trolleys shall have at least two ball bearing nylon or steel tired wheels spaced according to manufacturer's design criteria with four wheel trolleys at end posts.

2.4.3 Covering

Attach fabric to the framework with fasteners that permit easy removal of the cover but prevent sagging or separation. Position vertical seams in the bottoms of valleys and reinforce. Provide top and bottom edges of cover fabrics with 12 mm minimum turned hems.

2.4.4 Sound Insulation

Provide sound insulation as necessary to achieve the specified sound transmission class.

2.4.5 Air Release

Provide an air release system which will allow trapped air within the partition to be released during the stacking process.

2.4.6 Seals

Provide perimeter seals and sweep strips at top and bottom of partition.

Configure as necessary to produce the sound transmission class specified and to pass the visual field test specified.

2.4.7 Hardware

Provide hardware of the heavy-duty type standard with the manufacturer. Provide pulls and latches for all partitions. Provide partitions with keyed lock at Room 149A and privacy latches at all other locations.

2.4.8 Accessories

Provide ceiling guards and recessed tracks as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Existing Work

Check openings scheduled to receive accordion-folding partitions for correct dimensions.

Install partitions in accordance with the approved partition layouts, manufacturer's directions, and ASTM E 557. Structural support for the track support elements shall be as indicated.

3.1.2 Adjustment

Adjust manually operated partitions to open and close from any position with a maximum horizontal force of 130 N applied to pendant pull, box or handle.

3.2 FIELD TESTS

3.2.1 Operational Test

Operate partition at least three times to demonstrate that partition is capable of being moved from the stored position to the fully extended position smoothly and quietly. Adjust partitions which do not operate properly and retest.

3.2.2 Visual Test

Conduct visual field tests for light leakage with all room lights turned on in the space on one side of the partition. Darken space on the other side of the partition. There shall be no light leakage from the lighted space to the darkened space. If light leakage does occur, adjust the partition to correct the problem and retest.

3.2.3 Acoustical Test

Field sound performance: partitions shall be tested by an independent certified acoustical consultant in accordance with ASTM E 336, and achieve a Noise Isolation Class (NIC) of 30 plus or minus two. Adjust and/or

modify partitions which do not comply, and retest.

3.3 CLEANING

Clean any soiled parts of the partition according to manufacturer's instructions.

-- End of Section --

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1036	(2001) Flat Glass

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1190	Uniform Federal Accessibility Standards (UFAS)
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) for Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes; G
Accessory Items; G

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes; G
Accessory Items; G

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-07 Certificates

Accessory Items

Submit for each type of accessory specified, attesting that the items meet the specified requirements.

SD-10 Operation and Maintenance Data

Electric Hand Dryer; G

Complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.3 GENERAL REQUIREMENTS

Toilet accessories as specified herein shall be provided where indicated in accordance with paragraph "SCHEDULE". Porcelain type, tile-wall accessories are specified in SECTION 09310 CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates, anchors and fasteners. Concealed mounting plates shall be of sturdy construction with corrosion resistant surfaces. Accessories shall be installed consistent with the requirements of the ADAAG.

1.4 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of toilet accessories with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verify proper installation and operation, including finished appearance.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads, be the type provided by the accessory manufacturer and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, satin finish

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 32 mm OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have mounting holes concealed. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 2.225 kN vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 38 mm. Grab bar installations shall meet the requirements of 36 CFR 1190 and 36 CFR 1191.

2.2.2 Mirrors, Glass (MG), including ADA Mirrors (MG-1) and Full Length Mirrors (MG-2)

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or

more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.2.1 Framed Mirrors

Mirrors shall be framed unless indicated otherwise. Frames shall be angle type fabricated of roll formed 18 gauge type 304 stainless steel. Corners shall be heliarc welded, ground and polished smooth. Frame shall have a satin finish. Mirror shall be mounted with concealed, hanging brackets at top and bottom of frame, and connected with tamper resistant set screws. Back plates shall be one piece type. Mirror sizes as indicated.

2.2.2.2 Frameless Mirrors

Mirrors where indicated shall be frameless and mounted with semi-concealed clips. Frameless mirrors shall have a polished edge. Frameless mirrors shall be provide as one monolithic unit. Mirror sizes as indicated.

2.2.3 Mop Holder (MH)

Mop holder shall be stainless steel, satin finish with 4 rubber cam mop or broom holders.

2.2.4 Paper Towel Dispenser (PTD)

Paper towel dispenser shall be sized for a minimum capacity of 400 sheets of C-fold, single-fold, or quarter-fold towels. Dispenser shall be constructed of not less than 22 gauge carbon steel, and shall be surface mounted. Locking mechanism shall be tumbler key lock.

2.2.5 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR)

Dispenser/receptacle shall be semi-recessed and shall have a minimum capacity of 400 sheets of C-fold, single-fold, or quarter-fold towels. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.6 Robe Hook (RH)

Robe hook shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm. Design shall be consistent with design of other accessory items. Finish shall be satin.

2.2.7 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided for each SND installed. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be recessed at stud walls and surface mounted on toilet partitions.

2.2.8 Sanitary Napkin and Tampon Dispenser (SNTD)

Sanitary napkin and tampon dispenser shall be surface mounted. (Company Operations Facility Note: SNTD shall be recess mounted.) Dispenser, including door shall be Type 304 stainless steel and shall dispense both napkins and tampons with a minimum capacity of 20 each. Dispensing mechanism shall be for coin operation. Coin mechanisms shall have minimum denominations of 10 cents, 25 cents, 50 cents, and shall permit free distribution. Doors shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock. Keys for coin box shall be different from the door keys.

2.2.9 Shower Curtain (SC)

Shower curtain shall be minimum 10 ounce weight, nylon reinforced anti-bacterial vinyl fabric. Provide 2000 mm height with length to suit shower stall length. Curtain shall have all edges hemmed and have aluminum grommets at 150 mm on center. Curtain shall be flameproof, stain resistant and self-deodorizing. Color shall be white. Provide with curtain hooks sized for curtain rods.

2.2.10 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm outside diameterby 1.24 mm minimum thickness straight length to meet installation conditions.

2.2.11 Soap Dispenser - Wall (SD)

Soap dispenser shall be wall surface mounted, liquid type consisting of a Type 304 stainless steel tank with holding capacity of 1.2 L with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps. Provide vertical or horizontal mount units as indicated.

2.2.12 Shelf, Metal, Heavy Duty (SMHD)

Heavy duty metal shelf shall be minimum of 18 gauge stainless steel with hemmed edges. Shelves over 750 mm shall be provided with intermediate supports. Supports shall be minimum of 16 gauge, shall be welded to the shelf, and shall be spaced no more than 750 mm apart.

2.2.13 Towel Bar (TB)

Towel bar shall be stainless steel with a minimum thickness of 0.38 mm. Bar shall be minimum 19 mm diameter. Finish shall be satin.

2.2.14 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm. Design shall be consistent with design of other accessory items. Finish shall be satin.

2.2.15 Toilet Tissue Dispenser (TTD2)

Toilet tissue holder shall be Type II - surface mounted with two rolls of standard tissue mounted horizontally. Components shall be stainless steel, satin finish.

2.2.16 Waste Receptacle (WR)

Waste receptacle shall be Type 304 stainless steel, designed for surface mounting, without door. Reusable liner, of the type standard with the receptacle manufacturer, shall be provided. Capacity shall be not less than 75 liters (20 gallons).

2.2.17 Baby Changing Station (BCS)

Designed for horizontal type wall mount, high density polyethylene, with built in gas shock absorber, integrated sanitary bed liner dispenser, child safety strap, to support at least 130 kgs. Nominal overall dimensions 500 x 890 x 102 mm (h x w x d).

Representative products:
Koala Corporation: Horizontal Baby Changing Station
Bradley: Model 961
SynergySafety: Model 100 H

PART 3 EXECUTION

3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Brackets, plates, anchoring devices and similar items used for mounting accessories in showers and shower rooms shall be bedded in a silicone or polysulfide sealant as specified in Section 07920 JOINT SEALANTS as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, Teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

3.3 SCHEDULE

Room/ Space	GB	MG	MG2	BCS	PTD/WR	SC	SCR	SD	SND	SNTD	TTD2	TB	TP
108	2	1	1	-	1	1	1	1	-	-	1	1	2
121	-	1	1	-	1	-	-	2	-	-	-	3	-
122	4	3	1	1	2	-	-	3	6	1	6	-	-
123	-	1	1	-	1	-	-	2	-	-	-	3	-
124	2	-	1	-	-	1	1	1	-	-	-	1	2
126	4	3	1	1	2	-	-	3	-	-	3	-	-
132	4	3	1	1	2	-	-	3	-	-	3	-	-
136	4	3	1	1	2	-	-	3	6	1	6	-	-
143B	2	1	1	1	1	-	-	1	-	-	1	1	2

Room or Space	MG	MG2	MH	PTD	RH	SMHD	TB	WR
102A	1	-	-	-	1	-	1	-
102B	1	-	-	-	1	-	1	-
102C	1	-	-	-	1	-	1	-
104A	1	-	-	-	1	-	1	-
104B	1	-	-	-	1	-	1	-
104C	1	-	-	-	1	-	1	-
110	-	1	-	1	-	-	1	-
134	-	-	1	1	-	1	1	1
135	-	-	-	1	-	-	1	-
138	-	-	-	1	-	-	1	-

Rooms 102 and 104 each have 1 "MG2".

Rooms 115, 125, 130B, 133, 142 and 143 each have 1 "PTD".

-- End of Section --

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SECTION 10990

MISCELLANEOUS BUILDING SPECIALTIES

PART 1 GENERAL

1.1 SCOPE

This section includes requirements for the following specialty items:

a) TV/VCR Support and Wall Mounting Bracket
b) Recessed Floor Mats
c) Exterior Clock
d) Recessed Projector Platform (Lift)

See Section 05500 MISCELLANEOUS METALS for Exterior Entrance Gratings.

1.2 GENERAL REQUIREMENTS

Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

TV/VCR WALL MOUNTING BRACKET; G
RECESSED FLOOR MATS; G
EXTERIOR CLOCK; G
RECESSED PROJECTOR PLATFORM; G

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-03 Product Data

TV/VCR SUPPORT AND WALL MOUNTING BRACKET; G
RECESSED FLOOR MATS; G
EXTERIOR CLOCK; G
RECESSED PROJECTOR PLATFORM; G

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Items shall not be unpacked until they are needed for installation.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided. Specialties shall be warranted against defects in materials or workmanship for a minimum period of one year from date of final acceptance.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of postal specialties with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Verification of proper operation of all equipment and hardware.

(5) Protection of all specialties until facility occupancy.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 TV/VCR SUPPORT AND WALL MOUNTING BRACKET

TV/VCR wall mount system shall be a single arm design capable of supporting up to a 680 mm (diagonal) screen television (N.I.C.) with a minimum load capacity of 56 kg. A separate VCR mount, carried by the same arm, shall support a VCR (N.I.C.) with maximum dimensions of 435 x 105 mm. Mounting arm shall provide at least 100 degrees of side to side rotation, articulate from two swivel points and provide at least 10 degrees of forward tilt. Contractor shall submit shop drawings detailing the mounting system and all additional wall construction or reinforcement (including additional studs, mounting plates and anchors) required for installation. Walls at mounting locations shall not be covered with gypsum wall board until shop drawing

approval is received. Installation shall conform to manufacturer's written instructions. Coordinate location of power and CATV outlets on wall immediately behind TV/VCR location to minimize length of cable required.

2.2 RECESSED FLOOR MATS

Recessed floor mats shall be installed at interior locations, and in sizes shown, as indicated on drawings. Frames shall be extruded aluminum alloy cast into concrete floor. Frame configuration and depth shall be selected to meet detailed requirements for level bed or drain pan installation as indicated on drawings. Grid treads shall run perpendicular to the line of pedestrian traffic. Where required by frame or bed/pan depth, thicken floor section at grating to provide minimum concrete thickness indicated.

Color of all aluminum grating and frame components shall be black anodized. Coordinate slab recess and frame installation to ensure flush and level installation of grating surface with surrounding finished floor. Coordinate location of drain assembly and piping where required.

2.2.1 Rail/Tread Grid

Grids shall be composed of "I" section type rails of extruded 6105-T5 aluminum alloy with slotted aluminum tread surface designed to receive carpet strips. Rails shall be stabilized with intersecting bars. Tread depth shall be 40 to 50 mm with separate vinyl cushions on the bottom of each tread rail. Spacing of tread surface and carpet strips shall have open gaps between them to permit debris capture. Entire grid panel shall be removable as a single unit to permit periodic cleaning of pit.

2.2.2 Carpet Inserts

Carpet inserts shall be colorfast, solution dyed 100% nylon with 12-mil monofilament and a nominal weight of 33 oz. per square yard. Carpet and filaments shall be fusion bonded to backing. Each carpet strip shall be a continuous piece with splices for the full length of tread segment. Carpet shall be anti-static type, contain an antimicrobial additive and be Scotchguard treated.

2.2.3 Recessed Frame

Frame material shall be 6063-T5 aluminum alloy extrusion with mitered corners. Frame shall be permanently cast into concrete floor. Nominal exposed face width of 13 mm.

2.2.4 Reference Product

Reference product is provided for illustration purposes and does not preclude the use of an equal product meeting this specification:

"Pedigrid" with Heavy Duty Carpet insert and Level Base Frame by Construction Specialties, Inc. Carpet fabric color: as indicated on drawings.

2.3 EXTERIOR CLOCK

Exterior pediment mounted skeleton clock shall be a complete, integrated manufacturer's producted intended for exterior exposure. Surface mounted clock dial shall be size and materials as indicated on drawings. All exposed components shall be anodized aluminum in dark bronze or black color. No ferrous components shall be exposed to the weather. Clock hands shall be minimum 3 mm thick aluminum and shall have integrated balance rods or counterweights. Provide clock drive movement sized to match the diameter. Movement shall be designed for front maintenance access without requirement for internal building accessibility. Design shall provide a "maintenance free" product. Motors shall be high torque type with brass geared movement, stainless steel shafts and bronze bearings. Provide remote clock controller with quartz micro-processor, battery back-up, automatic correction for daylight savings time, and global positioning system interface for automated time correction.

2.4 RECESSED PROJECTOR PLATFORM

Projector platform shall be a scissor lift type mechanism designed to operate within a 610 x 610 ceiling tile grid. Provide extension capability up to 1 200 mm. Surface closure panel shall match room ACT. Provide all miscellaneous components, controls, limit switches, projector pan, plenum housing, ceiling finish kit, projector mounting bracket, factory installed RGB, HV, video and control cables consistent with facility television and communications cabling to develop a complete, finished installation. Lift motor shall have the U.L. label. Provide single station control with three position rocker switch.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall install building specialties as detailed, at locations indicated, as herein specified and in accordance with the manufacturer's written installation instructions. Conflicts in installation details or specifications shall be brought to the attention of the Contracting Officer and resolved prior to the installation of the building specialty in question. All materials shall be installed plumb, level and firmly attached to adjacent construction as appropriate. All require hardware, brackets and appurtenant features shall be provided with all building specialties for a complete, fully operational installation. Care shall be taken not to damage adjacent construction during installation of building specialties.

3.1.1 Installation of Recessed Floor Mats

Careful attention shall be given to the installation of floor frames and recesses to ensure that the mat grating and frame surface is installed level and flush with the adjacent finished floor surface and is solid and stable under foot traffic without rocking or displacement of any type.

3.1.2 Installation of TV/VCR Wall Bracket

Coordinate installation of steel stud walls to provide proper support

conditions for wall brackets and the resistance of the specified design loads, including seismic. Provide bridging and/or blocking as necessary to increase rigidity of wall at bracket. Installation method shall permit future demounting of support arm without destruction of adjacent finishes.

3.1.3 Installation of Exterior Clock

Install clock consistent with approved shop drawings and manufacturer's written instructions. Repair all damage done to FRP pediment and refinish/paint case to match adjacent surface as necessary to conceal clock mechanism in wall surface.

3.1.4 Installation of Recessed Projector Platform

Install platform lift mechanism consistent with approved shop drawings and manufacturer's written instructions. Mount to structure above to ensure stability and attachment under seismic loads. Finish exposed surface to blend with adjacent ceiling materials. Position as indicated on drawings and as necessary to provide appropriate line of sight to projection screen. Verify smooth operation of components.

3.2 PROTECTION AND REPAIR/REPLACEMENT OF DAMAGE ITEMS

Building specialties shall be installed and handled in a manner that shall prevent damage. Any damage that occurs shall be repaired to "like new" condition to the satisfaction of the Contracting Officer or the damaged item shall be replaced.

3.3 ADJUSTMENT AND CLEANING

All specialties shall be adjusted to conform with the operating characteristics identified by the manufacturer for proper operation. All mounting locations shall be inspected to ensure a solid anchorage. All loose components, sharp edges and other potential safety hazards to occupants shall be corrected. Clean all surfaces as recommended in writing by the manufacturer immediately prior to initial occupancy.

3.4 TRAINING

Not more than 14 days prior to facility occupancy the contractor shall demonstrate proper operation of all building specialties, including maintenance procedures, to representatives of the Contracting Officer and the user. Training shall include distribution of copies of all printed O&M materials produced by the manufacturer. Distribution of these materials does not relieve the contractor of the requirements of SECTION: OPERATION AND MAINTENANCE MANUALS.

-- End of Section --

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SECTION 11040

PREFABRICATED BAPTISTERY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

1.2 RELATED REQUIREMENTS

Conform to Sections 15400 PLUMBING SYSTEMS and 16415 ELECTRICAL WORK, INTERIOR.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Unit Baptistery; G

Provide manufacturers standard shop drawing package and installation drawings indicating the specific structural support, mechanical and electrical features of this installation.

SD-03 Product Data

Unit Baptistery; G

Provide complete manufacturer's descriptive information package, edited for the components and accessories used in this project.

Provide manufacturer's complete installation instructions

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Manuals shall feature all relevant engineering units in both English and Metric units. Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer Experience

Manufacturer shall have a minimum of 5 years continuous production of Baptistery Units using the materials and support systems specified.

1.4.2 Installer Certification/Experience

Installation shall be performed by personnel certified by the manufacturer and having at least 2 years of experience in the installation of Baptistery Units and associated systems.

1.5 DELIVERY, STORAGE AND HANDLING

Baptistery and accessories shall be delivered to the job site in protective packaging. Store out of contact with the ground, protected from the weather and incidental damage from other trades. Store in a fully supported manner as recommended by the manufacturer to avoid damage. Damaged materials shall be replaced or repaired at the direction of the Contracting Officer.

1.6 WARRANTY

Provide manufacturer's written five year, limited warranty against leaks, structural failure, and surface blistering, peeling or cracking.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Stainless Steel

ASTM A 167, Class 301, 302, or 304. Satin finish for exposed surfaces and No. 4 finish for interior surfaces.

2.1.2 Aluminum Alloy

ASTM B 221M equivalent in ultimate tensile, yield, and shear strengths to Alloy 6063-T5 or 6063-T6, as applicable.

2.1.3 Fiberglass Reinforced Polyester

Fiberglass reinforced polyester properties shall be within the following ranges:

Compressive Strength	ASTM D-695	137 - 186 mPa
Tensile Strength	ASTM D-638	82 - 97 mPa
Flexural Strength	ASTM D-790	137 - 200 mPa

2.2 COMPONENTS

Provide:

a. Baptistery unit complete with integral stairs and window

b. Flush port fill and drain fittings

c. Control system

d. Filter/Skimmer

e. Heating and Circulation System

f. Removable Cover

2.3 ITEMS

2.3.1 Baptistery Unit

Provide prefabricated baptistery unit in size and configuration as indicated. Unit shall be fibergalss reinforced polyester with integral stairs and window. Provide integral reinforcement to prevent, warping and buckling of unit due to weight of water or pedestrian traffic. Shell strength shall restrict deflection to no more than 40 mm when full. Steps shall conform to IBC 2003 requirements with riser height not greater than 180 mm and tread depth not greater than 280 mm. Steps shall have a permanent slip resistant pattern/texture. All corners shall be radiused for safety. There shall be no exposed sharp edges or fittings on Baptistery interior or exterior surfaces that are exposed in final construction. Provide a high gloss, polyester gel-coat finish. Window shall be plexiglass with nominal height of 300 mm. Color shall be selected from manufacturer's standard color range. Provide components with the following characteristics:

a. Fill and drain assembly: Brass construction with chrome plated finish. Fill and drain shall be electrically operated valves linked to control system. Drain shall be manual type, size as recommended for Baptistery depth with positive seal and overflow fitting.

b. Control system: Automatic control system activated with simple on/off switch. When turned on baptistery is automatically filled, stops filling when full, maintains water level, activates heater and recirculating system. When turned off baptistery shall automatically drain. Control system shall be key operated or secured in a key operated enclosure to prevent unauthorized use.

c. Filter/Skimmer: Device shall be a canister type filter with a washable filter insert. Filter shall be integrated with heating and circulation system.

d. Heating and Circulation System: Baptistery manufacturer's standard heater and pump combination. Heater shall be regulated by adjustable thermostat. Components shall be intended for commercial grade service with heavy duty contactors and pressure switch to prevent dry operation. Pump and heater shall be sized as indicated on the mechanical drawings.

e. Cover: Cover shall be a multiple piece, fully removable lid system, fabricated of material consistent with the Baptistery Unit. Attachment methodology shall be designed to restrict access by young children. Cover assembly shall be able to support a 250 pound person.

2.3.1 Reference Product

The reference product indicated in the drawings is a model "T2M-WF" as manufactured by:

Fiberglass Specialties, Inc.
P.O. Box 1340
Henderson, TX 75653
Phone: (800) 527-1459
Fax: (903) 657-2318

Products meeting these specifications and provided by other manufacturers are acceptable. If alternate products require changes to the configuration of surrounding construction, the contractor shall submit drawings depicting the new Baptistery dimensions and the proposed revisions to the area of installation.

PART 3 EXECUTION

3.1 WORKMANSHIP

Surfaces shall be kept free from grease, oil, dirt or other foreign materials and contaminants. Exposed corners and edges shall be rounded to eliminate sharp edges. All exposed surfaces, including inside of tank, to be free from pit-marks, visible weld seams, and abrasion damage.

3.2 INSPECTION

Verify that support framing, plumbing and electrical connections are all

installed consistent with Baptistery requirements and approved shop drawings.

3.3 INSTALLATION

Install items at locations indicated and as recommended by the manufacturer. Coordinate positioning of all components to ensure appropriate and unrestricted access for future maintenance activity. Conform to NFPA 70 for power and control wiring. Verify that Baptistery Unit is fully support and solid under foot whether dry or completely filled with water.

3.3.1 Post Installation Inspection

Examine the Baptistery and components for visual defects and conformance to specifications.

3.3.2 Test

Test to ensure that equipment is operational, completely and automatically fills and drains, and conforms to specification requirements.

-- End of Section --

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SECTION 11050

PREFABRICATED STEEPLE

PART 1 GENERAL

1.1 SUMMARY

Steeple shall be a factory fabricated assembly provided as indicated on drawings, specified herein and as required for a complete, structurally sound and watertight assembly. Steeple assembly shall include all structural framing necessary for support of the structure and connection to the building framing system indicated. Steeple assembly shall meet all pertinent requirements of the ICC IBC and in particular, non-combustible construction. Coordinate steeple framing and anchorage system with framing system of roof and building. Redesign and adjustment of roof/building framing as required by the steeple selected are the responsibility of the contractor.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 221	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2003) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(2003, 6th Ed) Architectural Sheet Metal Manual

1.3 RELATED REQUIREMENTS

Conform to Sections 05120 STRUCTURAL STEEL; 09100 METAL SUPPORT ASSEMBLIES; and 16415 ELECTRICAL WORK, INTERIOR.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steeple; G

Provide manufacturers standard shop drawing package and installation drawings indicating the specific structural support, cladding and electrical features of this installation. Drawings shall identify specific conformance with IBC. Drawings shall show roof/building framing system and steeple connection method. Obtain approval prior to fabrication.

SD-03 Product Data

Steeple; G

Provide complete manufacturer's descriptive information package, including specifications, edited for the components and accessories used in this project.

Provide manufacturer's complete installation instructions

SD-04 Samples

Steeple; G

Provide color samples of exterior cladding and flashing.

SD-05 Design Data

Steeple; G

Submit calculations demonstrating that cladding, structural frame and anchorage meet specified design loads. Confirm all structural values used to design roof and building framing that supports Steeple assembly. Calculations shall be signed by a licensed structural engineer.

SD-10 Operation and Maintenance Data

Steeple, Data Package 1; G

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

1.5 QUALITY ASSURANCE

1.5.1 Manufacturer Experience

Manufacturer shall have a minimum of 5 years continuous production of Steeples using the materials and support systems specified.

1.5.2 Installer Certification/Experience

Installation shall be performed by personnel certified by the manufacturer and having at least 3 years of experience in the installation of Steeples and associated framing and systems.

1.5.3 Materials

Verify that all materials are free from defect and conform to approved shop drawings.

1.6 DELIVERY, STORAGE AND HANDLING

Steeple and accessories shall be delivered to the job site in protective packaging. Store out of contact with the ground, protected from the weather and incidental damage from other trades. Store in a fully supported manner as recommended by the manufacturer to avoid damage. Damaged materials shall be replaced or repaired at the direction of the Contracting Officer.

1.7 WARRANTY

Provide manufacturer's written two year minimum warranty against loss of weathertightness, and defects in materials, workmanship or finish coatings.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Steel

Structural steel products shall conform to ASTM standards for grades used.

2.1.2 Structural Aluminum

Structural aluminum shall conform to ASTM B 221 and the Construction Manual of the Aluminum Association, Inc. Use alloy 6061-T6.

2.1.3 Aluminum Cladding

Aluminum cladding and flashings shall be 0.8 mm (.032 inch) minimum thickness 3003-H14 alloy.

2.2 COMPONENTS

Provide:

a. Steeple shall be devoid of symbols specific to any religious denomination.

b. Louvers shall be formed of separate weather resistant blades securely attached to a frame. Louvers shall be backed with aluminum or copper insect screen. Louver and screen shall be consistent with acoustical requirements for internally mounted steeple carillon system.

c. Trim and shapes including mouldings, cornices and ornaments shall be consistent with approved shop drawings.

d. Coordination of internal framing with Steeple access ladders and hatch to ensure that a clear path into the Steeple base is provided.

e. Provide lightning air terminals as indicated in Section 13100 LIGHTNING PROTECTION SYSTEM.

2.3 FABRICATION

2.3.1 Structural Frame

Structural steel framing fabricated to conform with AWS standards. Structural aluminum fabricated with aluminum rivets or welded. Bolts, nuts, washers, anchor rods and similar hardware utilized for anchorage connections shall be cadmium plated.

2.3.2 Cladding

Cladding shall be formed consistent with SMACNA Arch. Manual and standard sheet metal practices. Provide lockform seams. Where lockform is not possible to achieve, submit SMACNA consistent optional seam(s) for approval. Flat lap seams are not acceptable. Conceal exterior fasteners.

2.3.3 Sealants

Joints to be caulked or sealed shall be clean and dry. Use weathering silicone based sealants, color matched to cladding where visible, and consistent with the requirements of Section 07920 JOINT SEALANTS.

2.4 FINISHES

Coating on exposed exterior surfaces shall be PVF2 (Kynar 500, 700 or similar) type, color as indicated. Paint finish on concealed items shall be as indicated in Section 09900 PAINT AND COATINGS. Aluminum surfaces in contact with steel or other non compatible materials shall receive at least one coat of zinc primer. Steel surfaces shall receive two coats of zinc chromate primer and a top coat of aluminized bituminous paint.

PART 3 EXECUTION

3.1 WORKMANSHIP

Surfaces shall be kept free from grease, oil, dirt or other foreign materials and contaminants. Protect steeple assembly from contact damage

inducing dents, scratches, or distortion of shape. Do not erect steeple on building until damage is repaired to the satisfaction of the Contracting Officer.

3.2 INSPECTION

Verify that site conditions, building and roof support framing and electrical connections are all installed and completed consistent with Steeple manufacturer requirements and approved shop drawings.

3.3 INSTALLATION

Coordinate with other trades to insure that personnel are available and materials are at hand to ensure a complete and successful installation. Complete all cleaning and minor cosmetic repairs prior to lifting Steeple. Install anchorage at locations indicated, using personnel experienced in Steeple erection, utilizing anchorage components provided by the manufacturer and using the methodology recommended by the manufacturer and as approved in shop drawings. Coordinate positioning of all components to ensure appropriate and unrestricted access for future maintenance activity. Conform to NFPA 70 for wiring.

3.3.1 Post Installation Inspection

Examine the Steeple and components for visual defects and conformance to specifications. After final anchorage is achieved, verify that Steeple assembly is square and plumb by survey.

-- End of Section --

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SECTION 11452

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240/A 240M	(2003c) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 269	(2000) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM B 32	(2003) Solder Metal
ASTM D 520	(2000) Zinc Dust Pigment

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U. S. GREEN BUILDING COUNCIL

LEED-NC RG (May 2003) LEED-NC Reference Guide, Version 2.1

1.2 GENERAL REQUIREMENTS

Residential type appliances (drop-in ranges, exhaust hoods and dishwashers) shall be of the sizes and types shown. Equipment, materials, and fixtures required for use in conjunction with the items to be furnished by the Government (GFGI and GFCI) shall be furnished and installed by the Contractor. Any other equipment, materials, and fixtures indicated on the drawings and schedules shown shall be furnished and installed by the Contractor. Appliance models indicated for Government purchase are subject to change for a variety of reasons. Contractor shall review appliance purchase lists with the Contracting Officer during the course of construction to ensure that any revisions that may affect the contractor's work are coordinated.

1.2.1 Mechanical, Electrical, and Plumbing Work

Plumbing systems, including final connections, shall be in accordance with SECTION 15400 PLUMBING, GENERAL PURPOSE. Electrical equipment, motors, wiring, and final connections shall be in accordance with SECTION 16415 ELECTRICAL WORK, INTERIOR. Duct work and accessories shall be in accordance with SECTION 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Painting shall be in accordance with SECTION 09900 PAINTING, GENERAL.

1.2.2 Verification of Dimensions and Coordination of Project Data

The Contractor shall become familiar with all details of the work and shall advise the Contracting Officer of any discrepancy before performing any work. The Contractor shall perform the following:

a. Horizontal and vertical dimensions shall be field verified and coordinated with cabinetry production where necessary.

b. Contract drawings and submittal data shall be reviewed for accuracy and completeness.

c. The installed utility capacity and location shall be field checked.

d. Critical systems/components shall be reviewed for application and capacities such as ducting to exhaust hoods and electrical, water supply and wastewater connections.

e. Delivery shall be coordinated for access through finished openings and vertical handlings limitation within the building.

1.2.3 Standard Products

Materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of the products and shall essentially

duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience used shall include applications of equipment and materials under similar circumstances and of similar size. When two or more of the same products are supplied they shall be products of one manufacturer. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.4 Nameplates

Each item of equipment shall bear a stainless steel, aluminum, or engraved polyester nameplate, as standard with the manufacturer, located in a conspicuous position and permanently fastened to the equipment. Name or identification plates shall be of the size standard with the manufacturer for the particular piece of equipment provided. Name plates shall reflect the name of the manufacturer/trade name, serial number, make, and model number, pertinent ratings, operating characteristics, and other information as standard with the manufacturer, date of manufacture, electrical characteristics, and other applicable data, such as flow rate, temperature, pressure, capacity, and material of construction. Separate equipment identification plates with the contract number marked thereon, shall be securely fastened to the surface of each piece of equipment.

1.2.5 Underwriters Laboratories Standards

Electrically operated equipment shall be in accordance with applicable UL standards. Evidence of meeting the requirements shall be a UL label on the equipment, a UL listing mark per UL Elec. Equip Dir. or a certified test report from a nationally recognized independent testing laboratory indicating that the specific food service equipment has been tested and conforms to the applicable UL standards.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Residential Appliances; G
Installation; G

Data consisting of a complete list of equipment and materials. Detail drawings showing complete wiring, piping, and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation.

a. Detail drawings by Contractor shall be separate drawings and shall be the contractor's standard sheet size, but not smaller than the

contract drawings, and indicate the appliances with itemized schedule, and special conditions drawings indicating size and location of slab depressions, cores, wall openings, blockouts, ceiling pockets, blocking grounds, ceiling and wall, access panels, and above ceiling hanger assemblies, rough-in plumbing/mechanical systems and rough-in electrical systems.

b. Detail drawings by manufacturer shall be separate drawings; sheet size shall be manufacturer's standard size and indicate item number, name, and quantity, construction details, sections, and elevations, adjacent walls, columns, and equipment, plumbing and electrical schematics, and fabricated fixtures with single electrical or plumbing connection, and service access panels required for maintenance or replacement of mechanical or electrical components.

c. Detail drawings by the Contractor that show the size, type, and location of equipment drain lines, and floor drains. Drawings shall indicate drain lines from equipment, distances of drain lines and floor drain receptacles from equipment and aisles, and elevation views of drain piping and floor drains.

SD-03 Product Data

Residential Appliances; G

Manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Brochures shall have front and rear protective covers with labeled project name and include an index indicating item number, quantity, description, and manufacturer, a fly sheet for each component indicating item number, name, quantity, manufacturer, optional equipment, modification, special instruction, and utility requirements, and catalog specifications sheets.

SD-06 Test Reports

Testing; G

Test reports in booklet format showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Residential Appliances; G

Six complete copies of the service manual, not later than 1 month prior to the date of beneficial occupancy, with data for each different item of material and equipment specified. Service manuals shall include:

a. Front and rear protective covers with labeled project name.

b. Index indicating item number, quantity, description, manufacturer's name, and model number.

c. Maintenance instructions for stainless steel and plastic laminate.

d. Manufacturer's catalog specification sheets and manufacturer's detail and control drawings.

e. Manufacturer's operation manual outlining the step-by-step procedures for equipment installation, startup, basic operation features, and operation shutdown.

f. Manufacturer's maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the equipment as installed.

g. Manufacturer's list of parts and supplies with current unit price and address of manufacturer's parts supply warehouse.

SD-12 LEED Documentation

Recycled Content; G

Manufacturing Plant Location; G

Manufacturer's statement of material's post-consumer and post-industrial recycled content and location of the manufacturing plant where appliances are produced in accordance with LEED-NC RG

1.4 LEED OPPORTUNITIES

LEED-NC RG Credit 5.1 requires a minimum 20% of building materials and products to be manufactured regionally within a 500 mile radius of the project site. Contractor is encouraged to use regional manufacturers for appliances.

1.5 DELIVERY AND STORAGE

1.5.1 Delivery

Unless otherwise directed, the following procedures shall apply:

a. Field assembled fixed equipment integrated into structure shall be sent to jobsite when required.

b. Fixed equipment not integrated into structure shall be sent to the jobsite after completion of finished ceilings, lighting, and acidizing of the finished floor and wall systems, including painting.

c. Major movable equipment shall be delivered to inventory in a secured area for interim jobsite storage, or if secured area is not available, when fixed equipment installation/clean-up has been completed.

d. Minor appliances and loose items shall be delivered to the jobsite when the Contracting Officer is prepared to receive and inventory such items.

1.5.2 Storage

Items delivered and placed into storage shall be stored with protection from weather, humidity, and temperature variation, dirt and dust, or other contaminants.

1.5.3 Protection of Contractor Furnished and Installed (CFI) Manufactured Equipment and Appliances

Protective materials (plastic sheeting, cardboard, rigid or pliable foams, etc.) shall be taped to surfaces as required by equipment shape and installation access requirements. Finished surfaces of appliances exposed in final construction shall be protected at all times prior to beneficial occupancy. Remove protection when directed by C.O.R.

1.5.4 Protection of Government Furnished and Government Installed (GFGI) Appliances

Government furnished and installed appliances may be stored and/or installed within the facilities under construction prior to beneficial occupancy. Contractor shall at all times protect appliances located on site from incidental damage or contamination. The Government will coordinate all deliveries as to time and location with the Contractor in order to minimize job site conflicts. Contractor shall protect GFCI appliances consistent with requirements listed in paragraph "CFI Appliances".

1.5.5 Prohibited Use of Appliances/Equipment

Appliances shall not be used as tool and material storage, work bench, scaffold, or stacking area. Appliances shall not be used for their intended purpose except for testing necessary to verify full functionality following installation.

1.5.6 Damaged Appliances/Equipment

Contractor shall immediately submit documentation to the Contracting Officer with a recommendation of action for repair or replacement and the impact on project schedule.

1.6 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of residential appliances with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

(4) Coordination of all utility connections including water, waste, gas and electricity.

(5) Protection of all appliances.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 MATERIALS

Recyclable materials shall conform to EPA requirements in accordance with SECTION: RECYCLED / RECOVERED MATERIALS. Other materials shall conform to the following:

2.1.1 Stainless Steel, Nonmagnetic

ASTM A 167 or ASTM A 240/A 240M: 18-8, 300 Series, austenitic, polished to No. 3 or 4 finish on exposed surfaces.

2.1.2 Stainless Steel Pipe and Tubing

ASTM A 269. Pipe and tubing shall be seamless or welded, of the gauge specified, of true roundness, and of material as specified for stainless steel. Seamless tubing shall be thoroughly annealed, pickled, and ground smooth. Welded tubing shall be thoroughly heat-treated, quenched to eliminate carbide precipitation and then drawn true to size and roundness, and ground. Tubing shall be given a No. 3 or 4 finish when exposed to view.

2.1.3 Galvanizing Repair Compound

ASTM D 520, Type I pigment.

2.1.4 Brazing Material

AWS A5.8, class shall be as applicable.

2.1.5 Steel Structural Shapes for Framing

ASTM A 36/A 36M. Structural shapes shall be uniform, ductile in quality, and shall be free of hard spots, runs, checks, cracks and other surface defects. Sections shall be galvanized by the hot-dip process, conforming to ASTM A 123/A 123M.

2.1.6 Solder Material

ASTM B 32, Sn96.

2.2 APPLIANCES (GFGI)

2.2.1 Refrigerator/Freezer

Upright Refrigerator/Freezer units located in Rooms 135 and 138 (4 total). Nominal overall size of unit 711 x 1 711 x 810 mm (w x h x d). Nominal storage capacity 17 cubic feet. Verify size of units selected with C.O.R. Coordinate cabinet size and location to permit appliance location as indicated on drawings. Confirm appliance manufacturer's requirements for electric and water supply and provide wall outlets as required.

Representative products:
General Electric model GTS17BBRRWW
Frigidare model FRT17G4B
Maytag model PTB1753G

2.2.2 Dispensing Ice Machine

Dispensing Ice machine located in Room 138 shall be Manitowac SPA310 with S300 ice maker. Unit is water cooled and will provide up to 147 kgs. of daily ice production and up to 80 kgs of ice storage. Overall size of unit is 762 x 2 080 x 813 mm (w x h x d). Verify manufacturer, type and size of unit selected with C.O.R. Coordinate power, water supply and drainage (from both storage hopper and condenser) requirements including backflow prevention if necessary.

2.3 APPLIANCES (CFI)

2.3.1 Drop in Ranges

Ranges located in Rooms 135 and 138 (2 total) shall be an electric drop-in type complete with oven and smooth ceramic type cooktop. Oven shall be 4 cubic foot capacity, self-cleaning, with 2 racks and glass window door. Cooktop shall be four element, radiant type with "Ceran" or similar surface and 'hot surface' indicator lights. Nominal size of range shall be 780 x 710 x 670 mm (w x h x d). Coordinate size and configuration of cabinetry cutout with actual unit selected. Coordinate power outlet requirements with actual unit selected. Color of unit shall be white on white.

Representative products:
General Electric model JDP46WDWW.
Maytag model MEP5770A.
Whirlpool model RS696PXGQ

2.3.2 Exhaust Hoods

Exhaust hoods located in Rooms 135 and 138 shall be built-in, exhaust to exterior type. Features shall include multi-speed fan, removable/washable grease filters and internal hood light to illuminate range cooking surface. Nominal size of exhaust hood shall be 760 x 150 x 445 mm (w x h x d). Design of hood shall not create any exposed sharp metal edges. Coordinate size and configuration of cabinetry cutout with actual unit selected.

Coordinate power outlet, and vent ducting requirements with actual unit selected. Color of unit shall be white.

Representative products:
Broan Model 463011
GE Appliances Model JV535CWW
Whirlpool Model RH2330XJQ

2.3.3 Dishwashers

Dishwasher located in Rooms 135 and 138 shall be built in under countertop type. Features shall include Energy Star compliance, a tall tub with full height door, electrical digital touch controls and stainless steel interior. A noise reduction package shall be standard. Nominal size of dishwasher shall be 606 x 860 x 495 mm (w x h x d).

Representative products:
GE Appliances Model GSD6100KWW
Maytag Model MDB7751A
Whirlpool Model GU2500XTP

2.4 ELECTRICAL WORK

Electrical systems, components and accessories shall be certified to be in accordance with NFPA 70 and the following:

2.4.1 Electrical Equipment and Components

Appliances furnished under this section shall have loads, voltages, and phases compatible with building system, and shall conform to manufacturer standards.

2.4.2 Cords and Caps

Food service equipment cord/caps shall be coordinated with related receptacles. All 120/208/240 volt "plug-in" equipment shall have Type SO or SJO cord and a plug with ground, fastened to frame/body of item.

2.4.3 Heating Elements

Electrically heated equipment shall have thermostatic controls.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed at locations shown in accordance with NSF-01 and the manufacturer's written instructions. The Contractor shall make provision for the plumbing, heating, and electrical connections and for equipment indicated as being furnished and installed by the Government.

3.1.1 Equipment Connections

Equipment connections shall be complete for all utilities. Unless

otherwise specified, exposed piping shall be chromium-plated copper alloy.

Should the electrical load of the approved equipment differ from that specified or shown on the drawings, the contractor shall provide and install electrical service compatible with the approved equipment.

3.1.2 Backflow Preventers

Backflow preventers shall be furnished as specified in SECTION: PLUMBING, GENERAL PURPOSE. The Contractor is responsible to install backflow preventers as shown on the contract drawings and at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any source of nonpotable water, or other contaminant. Backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or will be located below the level of the contaminant. Backflow preventers shall be provided of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of waste or other contamination into the potable water system.

3.1.3 Plumbing Work

Plumbing final connection points of equipment shall be tagged, indicating item number, name of devices or components, and type of utility (water, gas, steam, drain). Extensions of indirect waste fitting shall be provided to open-sight hub drain, floor sink or floor drains from food service equipment.

3.1.4 Fastening Devices

Fastening devices shall be of the same material as the metal being joined when joint pieces are of similar metal. Fastening devices shall be stainless steel when stainless steel is joined to dissimilar metal. Stud bolts shall be a minimum of M6 (1/4-20) stainless steel with length necessary to accept washers, and required nuts, and shall be welded 225 mm on center maximum. Exposed surfaces of equipment shall be free of bolts, screws, and rivet heads. Stainless steel stud bolts shall be used to fasten tops of counters or tables to angle framing and trim to other surfaces. Such bolts shall be of the concealed type. Threads of stud bolts which are on the inside of fixtures and are either visible or might come in contact with a wiping cloth, shall be capped with chrome plated washers, lock washers, and chromium-plated brass cap nuts. Wherever bolts are welded to the underside of trim or tops, the reverse side of the welds shall be finished uniform with the adjoining surface of the trim or the top. Dimples at these points will not be acceptable.

3.1.5 Welding

3.1.5.1 Welding Rods

Welding shall be done with welding rods of the same composition as the sheets or parts welded.

3.1.5.2 Weld Quality

Welds shall be strong and ductile. Welds shall be free of imperfections such as pits, runs, spatter, cracks, low spots, voids, and shall be finished to have the same color as the adjoining surfaces. Butt welds made by welding straps under seams, or by filling in with solder, or by grinding will not be acceptable. Welded joints shall be homogeneous with the sheet metal. Spot welding shall not be substituted for continuous welding. Welds in galvanized steel made after galvanizing, and the adjacent areas where galvanizing is damaged, shall be cleaned and coated with galvanizing repair compound.

3.1.6 Soldering

Soldering shall serve only as a filler to prevent leakage and shall be made with solder material. Stainless steel requiring soldering shall first be cleaned of discoloration and then have a soldering flux applied. Excess or remaining flux and catalytic material shall be removed after the soldering has been completed, and the entire soldered joint and adjacent metallic surfaces shall be cleaned with a liquid alkaline or neutralizing agent to prevent any attack on the surrounding metallic surfaces by the soldering flux.

3.1.7 Brazing

Brazing shall be accomplished with brazing material. Brazing shall be used only on copper tubing to brass and bronze connection fittings.

3.2 TESTING

Equipment shall be inspected and tested under operating conditions after installation. If inspection or test shows defects, such defects shall be corrected, and inspection and test shall be repeated. Refrigerator tests shall include the following:

3.2.1 Operating Tests

An operating test shall be performed on all items (except GFGI) after complete installation and adjustment. The failed test item shall be corrected and the test shall be rerun.

3.2.2 Equipment Start-Up/Demonstration

As necessary, the Contractor shall obtain the services of the manufacturer's representative experienced in the installation, adjustment and operation of the equipment specified. The representative shall supervise the start-up, adjustment, and testing of the equipment, prior to the demonstration. Equipment shall be carefully tested, adjusted, and regulated in accordance with the manufacturer's instructions and shall be so certified in writing. A thorough operational demonstration shall be provided of all equipment and instructions furnished for general and specific care and maintenance. Selected items of equipment and attendees shall be scheduled, with the Contracting Officer, at least 2 weeks in advance of demonstration periods.

3.3 Clean and Adjust

Debris resulting from this work, as the installation progresses, shall be removed from the jobsite on the same day. All appliances, (except GFGI) prior to demonstration, shall be cleaned and polished, both interior/exterior. Drawer slides and casters shall be lubricated and adjusted. Pressure regulating valves, timed-delay relays, thermostatic controls, and temperature sensors, shall be adjusted, as required, for proper operation. Faucet aerators and line strainers shall be cleaned or replaced. Damage to painted finishes shall be touched up.

-- End of Section --

SECTION 12490

WINDOW TREATMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(1999) Fire Tests for Flame Propagation of Textiles and Films

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-03 Product Data

Window Blinds; G
Window Shades; G
Hardware

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Blinds; G
Window Shades; G
Colors; G

Samples of each type of window treatment. Provide manufacturer's full range of color samples for final color selection. Blind slats or louvers shall be 150 mm in length for each type. Track shall be 150 mm in length. Shade material shall be minimum 150 x

150 mm in size.

1.3 GENERAL REQUIREMENTS

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 10 degrees C.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

1.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of window blinds and shades with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced, or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

(1) Storage and handling of materials.

(2) Inspection of material delivered to the project site against approved material data.

(3) Shop drawings include explicit identification of coordination with other trades.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer within 24 hours following the observations, inspections, or tests.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color unless otherwise shown, and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

2.1.1 Horizontal Blinds

Horizontal blinds shall be Type II (25 mm slats), except as modified below. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be inside mount as shown. Installation brackets shall be completely concealed type.

2.1.1.1 Head Channel and Slats

Head channel shall be steel or aluminum nominal 0.61 mm for Type II. Slats shall be aluminum, not less than 0.203 mm thick, and of sufficient strength to prevent sag or bow in the finished blind. Distance between slats shall not exceed 19.6 mm. A sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap. Installation brackets shall be completely concealed type.

2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. Moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be of sufficient length to reach to within 1500 mm off the floor. For all windows that have a head height greater than 3000 mm, or where the wand cannot hang vertically due to obstruction, provide a heavy duty removable wand extension that will provide easy operation of the controls. Each room with windows requiring wands of this type shall be supplied with a wand and a wall mount for the wand.

2.1.1.3 Intermediate Brackets

Intermediate brackets shall be provided for installation of blinds over 1200 mm wide and shall be installed as recommended by the manufacturer.

2.1.1.4 Hold-Down Brackets

Universal type hold-down brackets for sill or jamb mount shall be provided and installed at locations where adjacent pedestrian traffic or doors are likely to cause movement of the blinds.

2.2 WINDOW SHADES

Shades shall operate smoothly and be of sufficient thickness to prevent excessive deflection and flutter. Brackets shall be provided that are appropriate for inside mount. The shade cloth shall meet the performance described in NFPA 701, small scale test.

2.2.1 Room Darkening (Black Out) Shades

2.2.1.1 Function

Shades shall be electrically operated, vertical roll-up, remote activated and completely opaque to light. Shades shall be mounted to the interior wall surface, overlapping at jambs and sill. Integration of shade system into head mounted soffit assembly as indicated.

2.2.1.2 Components

Roller tube shall be aluminum and shall be controlled by electric operator. Shade roller shall be manufacturer's standard product. Light traps shall be shop fabricated, and shall consist of a head box to house the shade roller, and U-shaped channels to serve as guides for the shade along the sides and to receive the bottom edge of the shade along the sill. Light trap shall be made of sheet steel having a minimum thickness of 0.85 mm (22 gauge)or anodized, extruded, aluminum. The legs of the channels shall be not less than 44 mm long and separated by the minimum distance that will permit free operation of the shade. Edges of light trap coming into contact with the shade cloth shall be smooth pile light seal. The exposed bottom face of the head box shall be hinged or removable for access to the shade roller. The interior or unexposed surfaces of the light trap shall have a finish coat of flat black enamel. The exposed portions of the light trap shall have a factory-applied priming coat of gray paint. Finish painting is specified in Section 09900 PAINTING, GENERAL. Aluminum shall be clear finish as shown.

2.2.1.3 Electric Operator

Electric operator shall be mounted inside roller. Coordinate mounting side with access required and position of adjacent light fixture in soffit assembly. Motor shall be 110 VAC single phase featuring and electric brake and accessible limit switches, internal thermal overload and lifetime lubricated. Motor shall be instantly reversible and furnished with devices as require to function with integrated remote control system.

2.2.1.4 Shade Cloth

Room darkening (black-out) window shades shall conform to the following: Cloth shall be of opaque type for blackout purposes. The shade shall be made from a single piece of woven fiberglass base textile with UV resistant vinyl film bonded to each side, or a fiberglass textile with acrylic backing. When not finished with a selvage, the vertical edges of the shade shall be bound or hemmed using a high-grade thread. Needle holes shall be made lightproof by applying a suitable filler. The bottom edge of the shade shall be fitted with a steel operating bar. Shades will engage positively with bottom rail through operating bar. Bars shall be painted

with flat black enamel. Shade shall use a retention system that resists normal air currents, inhibits noise from shade movement, prevents physical damage resulting from side channel disengagement.

2.2.1.5 Control Input Devices

Shade control system shall be RF type wireless control. Provide wall mounted remote control keypad as indicated on both Worship Center and Activity Area and wireless remote control. Wall mounted keypad shall have a key switch to provide for lockout capability. Control devices shall permit the following functional sequences:

a. Activity Area and Worship Center shades controlled independently.

b. All shades may be controlled as a group by wall (South or North).

2.3 COLOR

Colors shall be as indicated on drawings. Blinds and shades shall have aluminum and plastic components color coordinated to match slat and fabric colors.

PART 3 EXECUTION

3.1 WINDOW TREATMENT PLACEMENT SCHEDULE

3.1.1 Horizontal Blinds

Horizontal blinds shall be provided at all exterior windows except for the following locations:

a. glazing in interior and exterior doors, transoms and sidelights
b. clerestory windows
c. window at east wall of Baptistery

Provide horizontal blinds at all interior window locations indicated on drawings.

3.1.2 Window Shades (Room Darkening)

Provide window shades and integrated operating and control systems at the following locations:

a. Clerestory windows in Activity Area and Worship Center.

3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. Coordinate the installation of recessed shade pockets with soffit and trim. Coordinate all power supply and control wiring. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a

sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

3.3 TESTING AND DEMONSTRATION

Test blinds to verify that all operating mechanisms are functional. Test shades to verify that motorized operating mechanism, controls, limit switches, motor reversing, fabric retainer and other features are complete and functional. Verify during daylight hours, and with all interior lighting turned off, that there is no leakage of exterior daylight into the darkened spaces. Correct any deficiencies noted and retest.

3.4 PROTECTION AND CLEANING

If construction operations subsequent to blind installation cause contamination of the blinds and/or shades of any nature from any source, blinds and/or shades shall be cleaned as recommended in writing by the manufacturer.

-- End of Section --

SECTION 12495

CURTAIN, TRACK AND MACHINE

PART 1 GENERAL

1.1 SUMMARY

Provide operable curtain, track and machine assembly to separate Baptistery platform area from Altar Platform. Assembly shall be a stage type installation with pleated, bi-parting curtain, overhead concealed track and track mounted draw curtain machine with remote operator.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 3691	(2002) Woven, Lace, and Knit Household Curtain and Drapery Fabrics

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(1999) Fire Tests for Flame Propagation of Textiles and Films

UNDERWRITERS LABORATORIES (UL)

UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Curtain fabric; G

Submit a range of three samples, 300 by 300 mm or larger, to match the fabric quality, weight, pattern, and color shown or specified. Once selected, label approved samples to identify locations for their use in the project. Maintain identification and approval markings until final acceptance of the work.

Finished curtain; G

Provide one 600 by 600 mm or larger sample including curtain mounted hardware, pleats, and edge stitching to depict complete curtain construction methodology.

SD-06 Test Reports

Flame resistance; G

SD-08 Manufacturer's Instructions

Curtain and Track hardware

Special fabrication

Before fabrication, submit the manufacturer's printed instructions for fabrics requiring special fabrication methods.

SD-10 Operation and Maintenance Data

Curtain, Track and Machine system; G

1.4 SYSTEM REQUIREMENTS

Include laundering and dry cleaning instructions for fabrics requiring special care. Head each sheet with name and number of room in which each material is hung. In addition to instruction sheets, provide instructions on small, permanent sign affixed to the baptistery side of the curtain pocket.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver curtain and hardware to the site in sealed containers clearly labeled with manufacturer's name and contents. Store in a safe, dry, clean, and well ventilated area. Do not open containers until needed for installation, unless verification inspection is required.

1.6 QUALITY ASSURANCE

1.6.1 Manufacturer Experience

Manufacturer shall have a minimum of 5 years continuous production of curtain assemblies using the materials and support systems specified.

1.6.2 Installer Certification/Experience

Installation shall be performed by personnel certified by the manufacturer and having at least 3 years of experience in the installation of stage curtains and associated framing and systems.

1.6.3 Materials

Verify that all materials are free from defect and conform to approved shop

drawings.

1.7 WARRANTY

Provide manufacturer's written two year minimum warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Fabrics

2.1.1.1 Curtain Fabric

ASTM D 3691. Provide fabric manufactured from 100% polyester man-made fibers. Manufacturer shall be regularly engaged in the construction of stage curtain fabrics. Fabric physical characteristics shall be as follows:

a. Finished fabric weight: 0.67 to 0.85 kilograms per square meter (20 to 25 ounces per linear yard)

b. Pattern: Woven

c. Weave: Closed (0 to 7 percent)

d. Texture: Synthetic velvet or velour

e. Color: as indicated and selected from manufacturer's standard range

f. Light Transmittance: reduce light transfer by at least 50 percent.

2.1.1.2 Drapery Lining

Lining is not required, but may be provided at contractor's option to ensure stability and required reduction of light transmittance.

2.1.1.3 Flame Resistance

UL 214 or NFPA 701. Curtain fabric shall be either inherently or permanently flame resistant. Fabric and lining shall pass the small scale test. Treatment to enhance flame resistance shall be permanent type using vat immersion process. If treated, fabric shall pass the small scale test after being subjected to the accelerated dry cleaning or laundering cycles specified in UL 214 or NFPA 701.

2.1.2 Sewing Thread

Manufacturer's recommended thread for fabric type.

2.1.3 Curtain Top

Top of curtain shall be bound with jute, nylon or heavy-duty polyester webbing. Develop added fullness by incorporating box pleats on vertical seams and at intervals between seams not to exceed 300 mm. Provide brass grommets centered on each pleat sized for S-hooks or snap lock fasteners used.

2.1.4 Curtain Track Hardware

Traverse ceiling mounted tracks of heavy-duty type suitable for integration with machine operator. Track shall be box type with enclosed slot, complete with hangers, guides and dead end pulleys. Track shall be cold-rolled, commercial quality steel minimum or extruded aluminum minimum. Track cross section width and depth shall be sufficient to carry the drapery without sagging. Track configuration (number of channels) shall be such so as to permit drapery operation as specified or indicated. Finish steel components with a black baked enamel, vinyl, or epoxy coating as standard with the manufacturer. Finish aluminum components with a baked enamel, vinyl, or epoxy coating as standard with the manufacturer. Provide smooth and non-sticking sliding surfaces. Provide steel brackets, hangers and intermediate supports to suit the installation conditions indicated. Carriers shall be metal construction with neoprene or nylon, ball bearing wheels. Provide one manufacturer's design throughout.

2.1.5 Machine Operator

Machine operator shall be designed for draw type curtain and shall be mounted on track or wall adjacent to track. Floor mount is not acceptable. Provide enclosure of moving parts. Machine shall be accessible for maintenance from platform above Baptistery. Machine shall have minimum 1/2 horsepower motor, single phase 115 volt AC. Track mounted, cam type limit switches shall be set during installation for full open and full closed positions. Machine shall provide full function with curtain at any position along path of travel. Curtain machine shall be provided with disconnect switch, automatic thermal overload and safety relay features to protect against damage.

2.1.6 Control Switches

Provide three position (open/close/stop) control stations, located as indicated. Control stations shall be either a key switch or shall incorporate a locking cover to control access to the curtain control.

2.2 FABRICATION

Prior to cutting and fabrication, field measure the curtain opening location paying particular attention to field conditions affecting the work.

2.2.1 Drapery Fabrication

2.2.1.1 Panels

Make from full length fabric with no splices. Full widths of fabric to give a minimum of 100 percent fullness. Remove from bolts and inspect for flaws and imperfections prior to cut out. Provide conventional pleats.

Curtain shall be floor/sill length and shall hang 25 mm above finish floor. Accurately match patterned fabrics to provide identical designs horizontally and vertically. When fabricating panels from fabrics which require special methods or instructions, conform to the workroom instructions provided by the fabric manufacturer. Sew seams and hems using a firm interlocking stitch at a stitch rate per millimeter appropriate to fabric being sewn. Sew with enough slack present so that thread shrinkage due to laundering and dry cleaning will not pucker seams and hems. Do not expose seam and hem raw edges.

2.2.1.2 Headings

Pleat evenly to required widths. Make headings minimum 100 mm high with box pleats. Paper stiffening is not acceptable.

2.2.1.3 Seams

Join widths by serging, overlock, and safety stitch. Retain selvage when practical. All seams shall be hidden behind pleats to give the appearance of a continuous panel.

2.2.1.4 Hems

Double fold hems (top and bottom) and blind stitch so as not to show on the panel face. Make side seams 50 mm wide and bottom seams 150 mm deep. Leading hems shall 150 mm. Bottom hems shall have a suspended inner pocket with zinc coated chain sew at least 25 mm above hem bottom. Do not use lead or other toxic material for weights. When lining is attached to the drapery fabric, single fold heading is acceptable, however, double fold the bottom hem. Prior to finish sewing the bottom hem, the curtain shall be hung full height for at least two weeks.

2.2.2 Lining Fabrication

Attach lining to the back of the fabric panel with adjustable black hook and loop tape. Attach tapes to edge of vertical facebacks and top of bottom hem. Alternatively, sew lining into side and bottom hems and provide additional "shrinkage tuck" fabric. Hem fabric panel and lining panel separately at the bottom.

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that work of other trades and cleaning operations are completed.

3.2 INSTALLATION

Install curtain at Baptistery and as specified herein. Include all material indicated, specified, or necessary for a complete finished and operational curtain installation. Contractor shall be responsible for the required quantities of hardware for curtain, track and machine mounting.

3.2.1 Hardware

Install in accordance with the manufacturer's printed instructions and as specified herein. Install tracks parallel to ceiling slot and anchor as indicated in approved shop drawings. Provide fasteners for installation as follows:

Fastener	Structural Material
Wood or sheet metal screw	Wood
Self tapping screw	Metal
Case hardened, self-tapping sheet metal screw	Sheet metal
Screw or bolt in expansion shield	Solid masonry
Toggle or molly bolt	Hollow masonry, wallboard, plaster

3.2.2 Curtain

Install with clearances required between the ceiling and top of drapery heading. Floor length draperies shall hang 25 mm above finished floors. Insert heading hooks at rear of each pleat, placed to obtain the clearance specified. Press well before hanging, except fiberglass. Dress-down and adjust hung draperies to provide best form and appearance. Curtain shall operate smoothly and easily over the full range of travel. Remove incorrectly sized curtain and remake to correct size. Remove damaged, spotted, or otherwise defective fabric and repair to original state or replace with new material.

3.2.3 Machine Operator

Install as shown on shop drawings and as described in manufacturer's installation instructions.

-- End of Section --

SECTION 12670

PEWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 3597	(2002) Woven Upholstery Fabrics-Plain, Tufted, or Flocked

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1	(2000) American National Standard for Hardwood and Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(2002) High-Pressure Decorative Laminates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pew Construction; G

Drawings indicating, pew construction, accessories including kneelers and hymnal racks, pew ends, seat and back and overall dimensions, seat and back cushion padding and fabrics, and proposed finish. Drawings shall include overall layout of pews in Worship area showing pew to pew spacing and exit widths.

Installation; G

Drawings indicating pew plans showing row spacing, aisle widths, row lengths, back pitch, seat pitch and method of anchorage to floor.

SD-03 Product Data

Pews; G

Manufacturer's descriptive data, catalog cuts, and installation instructions.

Provide elevation drawings of the entire range of manufacturer's standard pew ends for selection/approval.

SD-04 Samples

Pews; G

Samples of upholstery (including fabric and cushion), veneer plywood, laminate, coatings, floor anchors, and finish materials. Fabric samples shall be of sufficient size to show color range, pattern, and finish. Wood samples shall have the specified finish system.

1.3 DELIVERY AND STORAGE

Pews shall not be delivered until the building temperature and humidity can be maintained in the normal occupancy range. Components shall be delivered to the site in unopened containers clearly labeled with the manufacturer's name and container contents. Materials shall be stored in a safe, dry, and clean location. Handling of items shall be in a manner that will protect the materials from damage.

1.4 Qualifications

1.4.1 Manufacturer

Pews shall be the product of a manufacturer who has been in the practice of designing and manufacturing wood/fabric pews for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.4.2 Installer

The installer shall be certified by the pew manufacturer. Installer experience shall include at least three projects that are of comparable size, scope and complexity as this project. The installer may be either employed by the manufacturer or be an independent installer.

1.5 WARRANTY

Manufacturer's lifetime warranty on structural wood components and minimum 10 year warranty on foam and fabric shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to pew information provided in contract drawings, this specification and listed standards. Recyclable materials (cushion padding, plastics, etc.) shall conform to EPA requirements in accordance with

Section 01670 RECYCLED / RECOVERED MATERIALS.

2.1.1 Lumber

2.1.1.1 Exposed

Solid lumber components including trim and edgebanding shall be hard maple or red oak standard with the manufacturer, FAS grade and kiln dried to 6 to 10 percent. Select grain and color to match veneer panel products.

2.1.1.2 Concealed

Solid lumber components used for framing, glue blocks and similar concealed construction shall be furniture grade hardwood.

2.1.2 Panel Products

2.1.2.1 Plywood

Plywood shall conform to HPVA HP-1. Face veneers for exposed surfaces shall be of Grade A hard maple or red oak standard to the manufacturer. Select panels for grain and color uniformity and book match. Unexposed veneers shall be sound grade hardwood or Grade A fir. All face veneers shall be not more than 1.6 mm in thickness, of clear stock, and free from imperfections.

2.1.2.2 Engineered panels

Engineered panels shall be industrial grade particleboard or similar product. Specific density of panel shall be at least 46 pcf. Veneer requirements as indicated for plywood.

2.1.3 Fabric

Fabric for pew seat and back shall generally conform to ASTM D 3597, be commercial, Grade A, woven 45% nylon, 39% polyester, 16% polyolefin upholstery fabric with the following characteristics:

Weight:	minimum 12 ounces per yard.
Abrasion resistance:	minimum 30,000 double rubs without damage
Colorfastness:	Class 5 - Wet, Class 4.5 Dry
Lightfastness:	Class 5 - 60 hours
Backing:	Puncture resistant acrylic/latex
Stain resistance:	Manufacturer applied stain resistant coating, (3M "Scotchguard" or equal)
BIFMA FF 1-78:	Class A
ASTM E-84:	Class A
Color:	Dark burgundy with horizontal and vertical varigated pattern

Reference Manufacturer:	Absecon
Pattern:	Fellowship
Color:	Autumn

2.1.4 Cushion Foam

Polyurethane foam shall be commonly used in furniture applications; be high density, fire retardant, nonhardening and non-oxidizing and have a high resistance to alkalis, oils, grease, soaps, abrasions, moisture, mildew, and tearing. Foam shall comply with the following general characteristics:

Air Flow:	minimum of 2.0 cfm
Compression Set:	less than 15%
Fillers:	none permitted
Indentation Force Deflection: (IFD)	30 - 35 (back), 40 - 60 (seat)
Resiliency:	40 - 55
CFC content:	none permitted

2.1.5 Hardware and Anchors

Corrosion resistant, intended for permanent fabrication of wood furniture. Floor anchors shall be lead-shielded expansion anchors designed for attachment to cast-in-place concrete.

2.1.6 Laminated Plastic Sheets

Laminated plastic sheets shall conform to NEMA LD 3, Type 1, Grade GP 50, nominal thickness 1.27 mm.

2.2 PEW COMPONENTS

2.2.1 General

Components and assembly shall be free from objectionable projections or irregularities. Corners and edges shall be smooth and rounded. Bolts, nuts, and other fastenings shall be recessed and plugged. Fastening shall be concealed where possible. All lumber components shall be hand sanded with 220 fine grit paper and hand inspected. Fiberboard components shall be drum sanded to produce near perfect surface for laminate bonding.

2.2.2 Pew Body

Pew bodies shall be composed of seat and back joined to form single section construction where possible. Fabrication techniques shall permit pew lengths of at least 6 000 mm. Pews that must be joint due to length or miter requirement shall be blind joined. Backs shall be a 19 mm minimum thickness veneer panel. Top of back shall have a molded hardwood cap rail attached with tongue and groove joinery, glued and blind nailed. Joinery and blocking of seat and back shall provide a solid mechanical connection and a smooth transition for seat cushion/fabric. Total back height shall be approximately 800 mm above finished floor.

2.2.3 Pew Ends

Pew ends shall be at least 50 mm thick, fabricated of solid lumber or veneer panels. Veneer panels shall have specie matched hardwood edgebanding. Pew backs and cap rails shall be routed into the pew end at

least 14 mm deep. Pew ends shall conform to the profile shown on drawings. Pew ends (and intermediate supports as necessary) shall have drilled pockets at base to permit totally concealed anchorbolt installation.

2.2.4 Supports

Supports shall be at least 38 mm thick, veneer panels with specie matched hardwood edgebanding. Provide supports at spacing not to exceed 1 800 mm.

2.2.5 Upholstered Seats

Provide 16 mm minimum thickness plywood base. Solid wood support rails/reinforcing shall be continuous at front and rear edges. Seat depth of 430 mm minimum. The seat foundation shall be free from visible screws, bolts, open holes, and projections on the bottom, front, and sides. Contoured foam cushion shall be fabricated of foam densities/thicknesses necessary to provide a comfortable and durable pad. Nominal foam thickness of 100 mm with wrap over coverage of seat nose. Design and installation methods for cushion and fabric shall provide for simplified re-upholstery.

2.2.6 Upholstered Backs

Provide 19 mm minimum thickness plywood or particleboard core structure. Contoured foam cushion shall be nominal 25 mm thick with additional 25 mm lumbar support. Cushion shall be fabricated of foam densities/thicknesses necessary to provide a comfortable and durable pad. Nominal foam thickness of 100 mm with wrap over coverage of seat nose. Fabric shall be only on front of back panel. Rear of back shall be a wood veneer surface with specie and finish to match other pew components. Design and installation methods for cushion and fabric shall provide for simplified re-upholstery.

2.2.7 Accessories

2.2.7.1 Kneelers

Provide kneelers for all pews. Kneelers shall be wood or steel construction as standard with the manufacturer. Kneelers shall be designed to rotate up and under pew seat such that no portion of the kneeler projects beyond the rear edge of pew supports. Do not provide kneelers on the last row of pews.

2.2.7.2 Bookracks

Bookracks shall be continuous type, with solid hardwood back panel (including 13 mm high clean out slot) and bottom. Include provision for pencil holders, envelope slot and plastic communion cup holder/silencer within each bookrack. Do not provide bookracks on the last row of pews.

2.3 FINISH

2.3.1 General

Finish system shall provide a long lived, resilient finish that resists discoloration or hazing due to contact with normal body oils and acids. Finish shall resist cracking and checking from variation in humidity and temperature. Finish shall be low luster, satin type that can be maintained with damp cloth wiping and does not require wax or polish.

2.3.2 Finish System

Finish shall include a penetrating oil based stain that is hand rubbed and applied to rejection (not spray applied). Utilize a precatalyzed sanding sealer with hand sanding for texture control. Surface coating shall be a high solids, non-yellowing, precatalyzed lacquer with u.v. inhibitors. Apply at least two coats of lacquer with hand sanding with 220 fine grit paper between coats. Stain finish color to match "Golden Oak" color as indicated on drawings.

PART 3 EXECUTION

3.1 **WARNING**

Pews rest on a concrete slab on grade that contains hydronic (radiant) heat piping. Carefully review depth and position of hydronic piping system. Do not drill or otherwise penetrate the slab to install fasteners at depths greater than 25 mm (1 inch). Provide drill penetration depth limit jigs that physically prevent over drilling of the slab. A tested method of adhering pews to concrete slab is an acceptable alternative or compliment to anchor bolt attachment.

3.2 Delivery

Contractor shall supervise delivery and short term storage of pew components to ensure that materials are positioned to minimize the risk of damage.

3.3 INSTALLATION

Installation of the pews shall be in accordance with the approved installation drawings and approved installation instructions. All pew components shall be installed level. plumb, true to line and positioned to match the designed room geometry. Back and seat panels shall be screw fastened at not more than 200 mm on center.

-- End of Section --

SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(2003) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 572/A 572M	(2003a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 603	(1998) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1996) Strength of Anchors in Concrete and Masonry Elements

ASME INTERNATIONAL(ASME)

ASME B18.2.1	(1996) Square and Hex Bolts and Screws

	(Inch Series)
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch Series)

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems outlined in Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT, the electrical equipment and systems outlined in Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, and the miscellaneous equipment and systems listed below. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads.

1.2.2 Miscellaneous Equipment and Systems

The bracing for the following miscellaneous equipment and systems shall be developed by the Contractor in accordance with the requirements of this specification:

Storage cabinets	Ornamentations
Storage Racks	Signs and Billboards
Shelving	Furnishings
Partitions	

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Bracing;
Resilient Vibration Isolation Devices;
Equipment Requirements ; G

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. For equipment and systems in buildings that have a performance objective higher than life-safety, the drawings shall be stamped by the registered engineer who stamps the calculations required above.

SD-03 Product Data

Bracing; G
Equipment Requirements; G

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

Rigidly mounted equipment shall be constructed and assembled to resist a horizontal lateral force of 0.50 times the operating weight of the equipment. For any rigid equipment which is rigidly attached on both sides of a building expansion joint, flexible joints for piping, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions, shall be provided.

1.4.2 Nonrigid or Flexibly-Mounted Equipment

Nonrigid or flexibly mounted equipment shall be constructed and assembled to resist a horizontal lateral force of 1.25 times the operating weight of the equipment at the vertical center of gravity of the equipment.

PART 2 PRODUCTS

2.1 BOLTS AND NUTS

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. ASTM A 325M (ASTM A 325) for bolts and nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153/A 153M.

2.2 SWAY BRACING

Material used for members listed in this section and/or on the drawings, shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A 36/A 36M, ASTM A 572/A 572M, Grade 503.

b. Wire rope, ASTM A 603.

c. Tubes, ASTM A 500, Grade B.

d. Pipes, ASTM A 53, Type E or S, Grade B.

e. Light gauge angles, less than 6 mm(1/4 inch) thickness, ASTM A 653/A 653M.

PART 3 EXECUTION

3.1 BRACING

Bracing shall conform to the arrangements shown. Trapeze-type hanger shall be secured with not less than two 13 mm (1/2 inch) bolts.

3.2 BUILDING DRIFT

Sway braces for a piping run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided.

3.3 ANCHOR BOLTS

3.3.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.3.2 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. Expansion or chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations if the adhesive is manufactured with temperature sensitive epoxies and the location is accessible to a building fire. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.3.2.1 General Testing

Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

3.3.2.2 Torque Wrench Testing

Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various

diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 9 mm (3/8 inch) sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

3.3.2.3 Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than 3 per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

Where the need for these devices is determined, based on the magnitude of the design seismic forces, selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS, except that an equipment weight equal to five times the actual equipment weight shall be used.

3.4.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 13 mm (0.5 inches).

3.4.2 Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on floor- or slab-mounted equipment. These snubbers shall provide 6 mm (0.25 inches) free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.5 SWAY BRACES FOR PIPING

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those shown on the drawings. Transverse sway

bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE. Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gauge (2 x 2 x 16 gauge) and one diagonal angle of the same size.

3.5.1 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided in accordance with Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.5.2 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.5.3 Maximum Length for Anchor Braces

Type	Size (millimeters)	Maximum Length* (meters)
Angles	38 x 38 x 6	1.5
	50 x 50 x 6	2.0
	64 x 38 x 6	2.5
	75 x 64 x 6	2.5
	75 x 75 x 6	3.0
Rods	91	1.0
	22	1.0
Flat Bars	38 x 6	0.4
	50 x 6	0.4
	50 x 10	0.5
Pipes (40s)	25	2.0
	32	2.8
	40	3.2
	50	4.0

Type	Size (inches)	Max Length ft-in
Angles	1-1/2 x 1-1/2 x 1/4	4-10
	2 x 2 x 1/4	6-6
	2-1/2 x 1-1/2 x 1/4	8-0
	3 x 2-1/2 x 1/4	8-10
	3 x 3 x 1/4	9-10
Rods	3/4	3-1
	7/8	3-8

Flat Bars	1-1/2 x 1/4	1-2
	2 x 1/4	1-2
	2 x 3/8	1-9
Pipes (40S)	1	7-0
	1-1/4	9-0
	1-1/2	10-4
	2	13-1

3.5.4 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 13 mm (1/2 inch) diameter.

3.6 EQUIPMENT SWAY BRACING

3.6.1 Suspended Equipment and Light Fixtures

Equipment sway bracing shall be provided for items supported from overhead floor or roof structural systems, including light fixtures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 13 mm (1/2 inch) bolts. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 1.25 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.6.2 Floor or Pad Mounted Equipment

3.6.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.6.2.2 Overturning Resistance

The ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. Calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.7 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 13100

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
NFPA 780	(2000) Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 96	(1994; Rev thru Jan 2000) Lightning Protection Components
UL 96A	(2001) Installation Requirements for Lightning Protection Systems
UL Elec Const Dir	(2003) Electrical Construction Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning

protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-07 Certificates

Materials

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL Elec Const Dir will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided on the Chapel.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be

electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 170 kg per 300 m (375 pounds per thousand feet), and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 600 mm above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 1.5 m above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 4.5 m above vent opening. Air terminals more than 600 mm in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

Steeple manufacturer shall provide one 600mm air terminal in accordance with UL 96 and NFPA 780 and two Class II copper down conductors at the top of the steeple.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to ANSI C135.30. Ground rods shall be not less than 19.1 mm (3/4 inch) in diameter and 3.048 m (10 feet) in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All down conductors shall be run through the building interior walls in metal conduit as shown. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 600 mm (2 feet) from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 600 mm (2 feet) in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 7.5 meters. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 50 mm for each 300 mm of increase over 7.5 meters. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 15 m in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 200 mm. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 900 mm along the roof and down the building to ground. Metal ventilators shall be

rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 35 m long, there shall be at least one additional down conductor for each additional 15 m of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 75 m in perimeter, there shall be at least one additional down conductor for each 30 m of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 30 meters. On structures exceeding 15 m in height, there shall be at least one additional down conductor for each additional 18 m of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 15 meters. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 5 m in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be run through the building interior walls in metal conduit as shown.

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between

the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 3.0 meters. Ground rods shall be set not less than 900 mm, nor more than 2.5 m, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms if a counterpoise is not used. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 2/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm deep at a distance not less than 900 mm nor more than 2.5 m from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors are then buried in the trenches.

3.1.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 30 meters. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters (3 square inches).

3.1.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and

down conductors. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters (3 square inches).

3.1.4 Ramps

Lightning protection for covered ramps (connecting passageways) shall conform to the requirements for lightning protection systems for buildings of similar construction. A down conductor and a driven ground shall be placed at one of the corners where the ramp connects to each building or structure. This down conductor and driven ground shall be connected to the counterpoise or nearest ground connection of the building or structure. Where buildings or structures and connecting ramps are clad with metal, the metal of the buildings or structures and metal of the ramp shall be connected to ensure electrical continuity, in order to avoid the possibility of a flash-over or spark due to a difference in potential.

3.2 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 0.258 square meters (400 square inches) or greater or a volume of 0.0164 cubic meters (1000 cubic inches) or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 1935.5 square millimeters (3 square inches).Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 1.5 m in any dimension, that is situated wholly within a building, and that does not at any point come within 1.8 m of a lightning conductor or metal connected thereto shall be independently grounded.

3.3 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

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SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 843	(1993; R 2003) Magnesium Alloy Anodes for Cathodic Protection

NACE INTERNATIONAL (NACE)

NACE RP0169	(2002) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0188	(1999) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE RP0190	(1995) External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G
Six copies of detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, results of system design calculations including soil-resistivity, installation instructions and certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

Contractor's Modifications; G
Six copies of detail drawings showing proposed changes in location, scope of performance indicating any variations from, additions to, or clarifications of contract drawings. The drawings shall show proposed changes in anode arrangement, anode size and number, anode materials and layout details, conduit size, wire size, mounting details, wiring diagram, method for electrically-isolating each pipe, and any other pertinent information to proper installation and performance of the system.

SD-03 Product Data

Equipment; G
Within 30 days after receipt of notice to proceed, an itemized list of equipment and materials including item number, quantity, and manufacturer of each item. The list shall be accompanied by a description of procedures for each type of testing and adjustments, including testing of coating for thickness and holidays. Installation of materials and equipment shall not commence until this submittal is approved.

Spare Parts

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than six (6) months prior to the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. One (1) spare anode of each type shall be furnished.

SD-06 Test Reports

Tests and Measurements;

Test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system and including close interval potential survey, casing and interference tests, final system test verifying protection, insulated joint and bond tests, and holiday coating test. A certified test report showing that the connecting method

has passed a 120-day laboratory test without failure at the place of connection, wherein the anode is subjected to maximum recommended current output while immersed in a three percent sodium chloride solution.

Contractor's Modifications;

Final report regarding Contractor's modifications. The report shall include pipe-to-soil measurements throughout the affected area, indicating that the modifications improved the overall conditions, and current measurements for anodes. The following special materials and information are required: taping materials and conductors; zinc grounding cell, installation and testing procedures, and equipment; coating material; system design calculations for anode number, life, and parameters to achieve protective potential; backfill shield material and installation details showing waterproofing; bonding and waterproofing details; insulated resistance wire; exothermic weld equipment and material.

SD-07 Certificates

Cathodic Protection System

Proof that the materials and equipment furnished under this section conform to the specified requirements contained in the referenced standards or publications. The label or listing by the specified agency will be acceptable evidence of such compliance.

Services of "Corrosion Expert"; G
Evidence of qualifications of the "corrosion expert."

a. The "corrosion expert's" name and qualifications shall be certified in writing to the Contracting Officer prior to the start of construction.

b. Certification shall be submitted giving the name of the firm, the number of years of experience, and a list of not less than five (5) of the firm's installations three (3) or more years old that have been tested and found satisfactory.

SD-10 Operation and Maintenance Data

Cathodic Protection System

Before final acceptance of the cathodic protection system, six copies of operating manuals outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance manual, listing routine maintenance procedures, recommendation for maintenance testing, possible breakdowns and repairs, and troubleshooting guides. The manuals shall include single-line diagrams for the system as installed;

instructions in making pipe-to-reference cell and tank-to-reference cell potential measurements and frequency of monitoring; instructions for dielectric connections, interference and sacrificial anode bonds; instructions shall include precautions to ensure safe conditions during repair of pipe or other metallic systems. The instructions shall be neatly bound between permanent covers and titled "Operating and Maintenance Instructions." These instructions shall be submitted for the Contracting Officer's approval. The instructions shall include the following:

a. As-built drawings, to scale of the entire system, showing the locations of the piping, location of all anodes and test stations, locations of all insulating joints, and structure-to-reference cell potentials as measured during the tests required by Paragraph: TESTS AND MEASUREMENTS, of this section.

b. Recommendations for maintenance testing, including instructions in making pipe-to-reference cell potential measurements and frequency of testing.

c. All maintenance and operating instructions and nameplate data shall be in English.

d. Instructions shall include precautions to insure safe conditions during repair of pipe system.

Training Course

The proposed Training Course Curriculum (including topics and dates of discussion) indicating that all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations, including testing procedures included in the maintenance instructions, are to be covered.

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish and install a complete, operating, sacrificial anode cathodic protection system in complete compliance with NFPA 70, with all applicable Federal, State, and local regulations and with minimum requirements of this contract. The services required include planning, installation, adjusting and testing of a cathodic protection system, using sacrificial anodes for cathodic protection of the Fire Protection lines, and their connectors. The cathodic protection system shall include anodes, cables, connectors, corrosion protection test stations, and any other equipment required for a complete operating system providing the NACE criteria of protection as specified. Insulators are required whenever needed to insulate the pipes from any other structure. AThe cathodic protection shall be provided on Fire Protection pipes.

1.3.1 Services of "Corrosion Expert"

The Contractor shall obtain the services of a "corrosion expert" to supervise, inspect, and test the installation and performance of the cathodic protection system. "Corrosion expert" refers to a person, who by thorough knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. Such a person must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection (CP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control of buried or submerged metallic piping and tank systems, if such certification or licensing includes 5 years experience in corrosion control on underground metallic surfaces of the type under this contract. The "corrosion expert" shall make at least 3 visits to the project site. The first of these visits shall include obtaining soil resistivity data, acknowledging the type of pipeline coatings to be used and reporting to the Contractor the type of cathodic protection required. Once the submittals are approved and the materials delivered, the "corrosion expert" shall revisit the site the ensure the Contractor understands installation practices and laying out the components. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The "corrosion expert" shall supervise installation and testing of all cathodic protection.

1.3.2 Contractor's Modifications

The specified system is based on a complete system with magnesium sacrificial anodes. The Contractor may modify the cathodic protection system after review of the project, site verification, and analysis, if the proposed modifications include the anodes specified and will provide better overall system performance. The modifications shall be fully described, shall be approved by the Contracting Officer's representative, and shall meet the following criteria. The proposed system shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolts with reference to a saturated copper-copper sulfate reference cell on the underground components of the piping or other metallic surface. The Contractor shall take resistivity measurements of the soil in the vicinity of the pipes and ground bed sites. Based upon the measurements taken, the current and voltage shall be required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential shall be obtained over 95 percent of the metallic area. The anode system shall be designed for a life of twenty-five (25) years of continuous operation.

1.3.3 Summary of Services Required

The scope of services shall include, but shall not be limited to, the following:

a. Close-interval potential surveys.

b. Cathodic Protection Systems.

c. System testing.

d. Casing corrosion control.

e. Interference testing.

f. Training.

g. Operating and maintenance manual.

h. Insulator testing and bonding testing.

i. Coating and holiday testing shall be submitted within 45 days of notice to proceed.

1.3.4 Nonmetallic Pipe System

In the event pipe other than metallic pipe is approved and used in lieu of metallic pipe, all metallic components of this pipe system shall be protected with cathodic protection. Detailed drawings of cathodic protection for each component shall be submitted to the Contracting Officer for approval within 45 days after date of receipt of notice to proceed, and before commencement of any work.

1.3.4.1 Coatings

Coatings for metallic components shall be as required for metallic fittings. Protective covering (coating and taping) shall be completed and tested on each metallic component (such as valves, hydrants and fillings). This covering shall be as required for underground metallic pipe. Each test shall be witnessed by the Contracting Officer. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications. The use of nonmetallic pipe does not change other requirements of the specifications. Any deviations due to the use of nonmetallic pipe shall be submitted for approval.

1.3.5 Drawings

Detailed drawings shall be provided showing location of anodes, insulated fittings, test stations, permanent reference cells, and bonding. Locations shall be referenced to two (2) permanent facilities or mark points.

1.3.6 Electrical Potential Measurements

All potential tests shall be made at a minimum of 3 meter intervals witnessed by the Contracting Officer. Submittals shall identify test locations on separate drawing, showing all metal to be protected and all cathodic protection equipment. Test points equipment and protected metal shall be easily distinguished and identified.

1.3.7 Metallic Components and Typicals

a. Fire Hydrants: Fire hydrant pipe components shall have a minimum of two (2) anodes. These magnesium anodes shall have an unpackaged weight of 7.7 kg .

1.3.8 Metallic Component Coating

Coatings for metallic components shall be as required for metallic fittings as indicated. This will include fire hydrants, T's, elbows, valves, etc. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications.

PART 2 PRODUCTS

2.1 MAGNESIUM ANODES

A minimum of 2 anodes shall be installed on the Pipe system. See Paragraph METALLIC COMPONENTS AND TYPICALS for additional anodes under slab.

2.1.1 Anode Composition

Anodes shall be of high-potential magnesium alloy, made of primary magnesium obtained from sea water or brine, and not made from scrap metal. Magnesium anodes shall conform to ASTM B 843 and to the following analysis (in percents) otherwise indicated:

Aluminum, max.	0.010
Manganese, max.	0.50 to 1.30
Zinc	0.05
Silicon, max.	0.05
Copper, max.	0.02
Nickel, max.	0.001
Iron, Max.	0.03
Other impurities, max.	0.05 each or 0.3 max. total
Magnesium	Remainder

The Contractor shall furnish spectrographic analysis on samples from each heat or batch of anodes used on this project.

2.1.2 Dimensions and Weights

Dimensions and weights of anodes shall be approximately as follows:

TYPICAL MAGNESIUM ANODE SIZE

(Cross sections may be round, square, or D shaped)

NOMINAL WT. kg.	APPROX. SIZE (mm)	NOMINAL GROSS WT kg PACKAGED IN BACKFILL	NOMINAL PACKAGE DIMENSIONS (mm)
7.7	102 X 102 X 432	20.5	191 X 610

2.1.3 Packaged Anodes

Anodes shall be provided in packaged form with the anode surrounded by specially-prepared quick-wetting backfill and contained in a water permeable cloth or paper sack. Anodes shall be centered by means of spacers in the backfill material. The backfill material shall have the following composition, unless otherwise indicated:

Material	Approximate Percent by Weight
Gypsum	75
Bentonite	20
Sodium Sulphate	5
Total	100

2.1.4 Connecting Wire

2.1.4.1 Wire Requirements

Wire shall be No. 12 AWG solid copper wire, not less than 3 meters long, unspliced, complying with NFPA 70, Type TW insulation. Connecting wires for magnesium anodes shall be factory installed with the place or emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Test Stations

Stations shall be of the flush-curb-box type and shall be the standard product of a recognized manufacturer. Test stations shall be complete with an insulated terminal block having the required number of terminals. The test station shall be provided with a lockable over and shall have an embossed legend, "C.P. Test." A minimum of one (1) test station shall be provided each component of the pipe . A minimum of six (6) terminals shall be provided in each test station. A minimum of two (2) leads are required to the metallic pipe from each test station. Other conductors shall be provided for each anode, other foreign pipe, and reference cells as required. Test stations may be constructed of nonmetallic materials. However, if nonmetallic materials are utilized, as a minimum, the materials shall be resistant to damage from ultraviolet radiation, contain good color retention qualities, contain high strength qualities, and be resistant to accidental or vandalistic impacts that might be normally encountered in the environment for which they are to be installed. The test stations shall be listed for the particular application for which they are to be utilized.

2.2.2 Underground Structure Coating

2.2.2.1 Field Joints

All field joints shall be coated with materials compatible with the pipeline coating compound. The joint coating material shall be applied to an equal thickness as the pipeline coating. Unbonded coatings shall not be used on these buried metallic components. This includes the elimination of all unbonded polymer wraps or tubes. Once the pipeline or vessel is set in

the trench, an inspection of the coating shall be conducted. This inspection shall include electrical holiday detection. Any damaged areas of the coating shall be properly repaired. The Contracting Officer shall be asked to witness inspection of the coating and testing using a holiday detector.

2.2.2.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer's representative to determine suitability of the detector. All labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

a. Protective covering for aboveground piping system: Finish painting shall conform to the applicable paragraph of SECTION: 09900 PAINTS AND COATINGS and as follows:

b. Ferrous surfaces: Shop-primed surfaces shall be touched-up with ferrous metal primer. Surfaces that have not been shop-primed shall be solvent-cleaned. Surfaces that contain loose rust, loose mil scale, and other foreign substances shall be mechanically-cleaned by power wire-brushing and primed with ferrous metal primer. Primed surface shall be finished with two (2) coats of exterior oil paint and vinyl paint. Coating for each entire piping service shall be an approved pipe line wrapping having a minimum coating resistance of 50,000 Ohms per 0.0929 square meters .

2.2.3 Resistance Wire

Wire shall be No. 16 or No. 22 nickel-chromium wire with TW insulation.

2.2.4 Electrical Connections

Electrical connections shall be done as follows:

a. Exothermic welds shall be "Cadweld", " Bundy", "Thermoweld", or an approved equal. Use of this material shall be in strict accordance with the manufacturer's recommendations.

b. Electrical-shielded arc welds shall be approved for use on steel pipe by shop drawing submittal action.

c. Brazing shall be as specified in Paragraph: Lead Wire Connections.

2.2.5 Electrical Tape

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.6 Permanent Reference Electrodes

Permanent reference electrodes shall be Cu-CuS04 electrodes suitable for direct burial. Electrodes shall be guaranteed by the supplier for 15 years' service in the environment in which they shall be placed. Electrodes shall be installed directly beneath pipe, or metallic component.

2.2.7 Casing

Where a pipeline is installed in a casing under a roadway or railway, the pipeline shall be electrically insulated from the casing, and the annular space sealed and filled with an approved corrosion inhibiting product against incursion of water.

PART 3 EXECUTION

3.1 CRITERIA OF PROTECTION

Acceptance criteria for determining the adequacy of protection on a buried underground metallic component shall be in accordance with NACE RP0169 and as specified below.

3.1.1 Iron and Steel

The following method a. shall be used for testing cathodic protection voltages. If more than one method is required, method b. shall be used.

a. A negative voltage of at least minus 850 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode connecting the earth (electrolyte) directly over the underground component. Determination of this voltage shall be made with the cathodic protection system in operation. Voltage drops shall be considered for valid interpretation of this voltage measurement. A minimum of minus 850 millivolts voltage shift shall be achieved over 95 percent of the area of the structure.

b. A minimum polarization voltage shift of 100 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode contacting the earth directly over the underground component. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay. Measurements achieving 100 millivolts decay shall be made over 95 percent of the metallic surface being protected.

c. For any metallic component, a minimum of four (4) measurements shall be made using subparagraph a., above, and achieving the voltage shift potential of minus 850 millivolts. Two (2) measurements shall be made over the anodes and two (2) measurements shall be made at

different locations near the component and farthest away from the anode.

3.2 ANODE STORAGE AND INSTALLATION

3.2.1 Anode Storage

Storage area for magnesium anodes will be designated by the Contracting Officer. If anodes are not stored in a building, tarps or similar protection should be used to protect anodes from inclement weather. Packaged anodes, damaged as a result of improper handling or being exposed to rain, shall be resacked by the Contractor and the required backfill added.

3.2.2 Anode Installation

Unless otherwise authorized, installation shall not proceed without the presence of the Contracting Officer. Anodes of the size specified shall be installed to the depth indicated and at the locations shown. Locations may be changed to clear obstructions with the approval of the Contracting Officer. Anodes shall be installed in sufficient number and of the required type, size, and spacing to obtain a uniform current distribution over the surface of the structure. The anode system shall e designed for a life of 25 years of continuous operation. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective covering has been completely removed from the water permeable, permanent container housing the anode metal. The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 150 mm layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 20 L of water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 150 mm above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

3.2.2.1 Single Anodes

Single anodes, spaced as shown, shall be connected through a test station to the pipeline, allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

3.2.2.2 Welding Methods

Connections to ferrous pipe shall be made by exothermic weld methods manufactured for the type of pipe supplied. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.2.3 Anode Placement - General

Packaged anodes shall be installed completely dry, and shall be lowered into holes by rope sling or by grasping the cloth gather. The anode lead wire shall not be used in lowering the anodes. The hole shall be backfilled with fine soil in 150 mm layers and each layer shall be

hand-tamped around the anode. Care must be exercised not to strike the anode or lead wire with the tamper. If immediate testing is to be performed, water shall be added only after backfilling and tamping has been completed to a point 150 mm above the anode. Approximately 8 L of water may be poured into the hole. After the water has been absorbed by the soil, backfilling and tamping may be completed to the top of the hole. Anodes shall be installed as specified or shown. In the event a rock strata is encountered prior to achieving specified augered-hole depth, anodes may be installed horizontally to a depth at least as deep as the bottom of the pipe, with the approval of the Contracting Officer.

3.2.4 Installation Details

Details shall conform to the requirements of this specification. Details shown on the drawings are indicative of the general type of material required, and are not intended to restrict selection to material of any particular manufacturer.

3.2.5 Lead Wire Connections

3.2.5.1 Underground Pipeline (Metallic)

To facilitate periodic electrical measurements during the life of the sacrificial anode system and to reduce the output current of the anodes, if required, all anode lead wires shall be connected to a test station and buried a minimum of 610 mm in depth. The cable shall be No. 10 AWG, stranded copper, polyethylene or RHW-USE insulated cable. The cable shall make contact with the structure only through a test station. Resistance wire shall be installed between the cable and the pipe cable, in the test station, to reduce the current output, if required. Anode connections, except in the test station, shall be made with exothermic welding process, and shall be insulated by means of at least three (3) layers of electrical tape; and all lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin. Lead wire-to-structure connections shall be accomplished by an exothermic welding process. All welds shall be in accordance with the manufacturer's recommendations. A backfill shield filled with a pipeline mastic sealant or material compatible with the coating shall be placed over the weld connection and shall be of such diameter as to cover the exposed metal adequately.

3.2.6 Location of Test Stations

Test stations shall be of the type and location shown and shall be curb box mounted. Buried insulating joints shall be provided with test wire connections brought to a test station.

3.2.7 Underground Pipe Joint Bonds

Underground pipe having other than welded or threaded coupling joints shall be made electrically continuous by means of a bonding connection installed across the joint.

3.3 TRENCHING AND BACKFILLING

Trenching and backfilling shall be in accordance with Section 02300 EARTHWORK.

3.4 TESTS AND MEASUREMENTS

3.4.1 Baseline Potentials

Each test and measurement will be witnessed by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of five (5) working days prior to each test. After backfill of the pipe, the static potential-to-soil of the pipe shall be measured. The locations of these measurements shall be identical to the locations specified for pipe-to-reference electrode potential measurements. The initial measurements shall be recorded.

3.4.2 Cathodic Protection Meter

A Model B3A2 cathodic protection meter, as manufactured by "M.C. Miller", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. This test shall be performed in addition to the Model 601 insulation checker. Continuity is checked across the isolation joint after the test lead wire is shorted together and the meter adjusted to scale. A full-scale deflection indicates the system is shorted at some location. The Model 601 verifies that the particular insulation under test is good and the Model B3A2 verifies that the system is isolated. If the system is shorted, further testing shall be performed to isolate the location of the short.

3.4.3 Anode Output

As the anodes or groups of anodes are connected to the pipe , current output shall be measured with an approved clamp-on milliammeter, calibrated shunt with a suitable millivoltmeter or multimeter, or a low resistance ammeter. (Of the three methods, the low-resistance ammeter is the least desirable and most inaccurate. The clamp-on milliammeter is the most accurate.) The values obtained and the date, time, and location shall be recorded.

3.4.4 Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulphate reference electrode and a potentiometer-voltmeter, or a direct-current voltmeter having an internal resistance (sensitivity) of not less than 10 megohms per volt and a full scale of 10 volts. The locations of these measurements shall be identical to the locations used for baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded. No less than eight (8) measurements shall be made over any length of line or component. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.4.5 Location of Measurements

3.4.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Pipe-to-soil potential measurements shall be made at each fire hydrant. The Contractor may use a continuous pipe-to-soil potential profile in lieu of 1.5 m interval pipe-to-soil potential measurements. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line adjacent to the riser. Potentials shall be plotted versus distance to an approved scale. Locations where potentials do not meet or exceed the criteria shall be identified and reported to the Contracting Officer's representative.

3.4.5.2 Recording Measurements

All pipe- to-soil potential measurements, including initial potentials where required, shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe- to-soil potential measurements shall be taken on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

3.5 CLEANUP

The Contractor shall be responsible for cleanup of the construction site. All paper bags, wire clippings, etc., shall be disposed of as directed. Paper bags, wire clippings and other waste shall not be put in bell holes or anodes excavation.

3.6 MISCELLANEOUS INSTALLATION AND TESTING

3.6.1 Coatings

All aboveground pipeline shall be coated as indicated or as approved. The coating shall have a minimum thickness of 0.18 mm . The pipeline coating shall be in accordance with all applicable Federal, State, and local regulations.

3.6.2 Excavation

In the event rock is encountered in providing the required depth for anodes, the Contractor shall determine an alternate approved location and, if the depth is still not provided, an alternate plan shall be submitted to the Contracting Officer. Alternate techniques and depths must be approved prior to implementation.

3.7 SPARE PARTS

After approval of shop drawings, and not later than three (3) months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts, special tools, and

supplies, with current unit prices and source of supply. In addition, the Contractor shall supply information for material and equipment replacement for all other components of the complete system, including anodes, cables, splice kits and connectors, corrosion test stations, and any other components not listed above.

3.8 SEEDING

Seeding shall be done by the Contractor, as directed, in all unsurfaced locations disturbed by this construction. In areas where grass cover exists, it is possible that sod can be carefully removed, watered, and stored during construction operations, and replaced after the operations are completed since it is estimated that no section of pipeline should remain uncovered for more than two (2) days. The use of sod in lieu of seeding shall require approval by the Contracting Officer.

3.9 SYSTEM TESTING

The Contractor shall submit a report including potential measurements taken at adequately-close intervals to establish that minus 850 millivolts potential, voltage shift potential, is provided, and that the cathodic protection is not providing interference to other foreign pipes causing damage to paint or pipes. The report shall provide a narrative describing how the criteria of protection is achieved without damaging other pipe or structures in the area.

3.10 CLEARING OF TREES AND UNDERBRUSH

In the areas of the anode beds, all trees and underbrush shall be cleared and grubbed to the limits shown or indicated.

-- End of Section --

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SECTION 13851

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41	(1990; R 1996) Audible Emergency Evacuation Signal

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(1999) Installation, Maintenance and Use of Public Fire Service Communication Systems
NFPA 70	(2005) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1971	(1995; Rev thru Apr 1999) Signaling Devices for the Hearing Impaired
UL 228	(1997; Rev Jan 1999) Door Closers-Holders, With or Without Integral Smoke Detectors

UL 268	(1996; Rev thru Jan 1999) Smoke Detectors for Fire Protective Signaling Systems
UL 268A	(1998) Smoke Detectors for Duct Application
UL 38	(1999) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 464	(1996; Rev thru May 1999) Audible Signal Appliances
UL 521	(1999) Heat Detectors for Fire Protective Signaling Systems
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 797	(2000; Rev thru May 2003) Electrical Metallic Tubing
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Alarm Reporting System; G,

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

SD-03 Product Data

Storage Batteries;

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop;

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts;

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G,

Technical data which relates to computer software.

Training; G

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing;

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

SD-06 Test Reports

Testing; ,

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report

shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment; G

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications;

Proof of qualifications for required personnel. The installation contractor shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G,
Six copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided. Keys shall be 211 core type.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

b. A registered professional engineer (P.E.) in fire protection engineering.

c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.

d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the

panel for smoke detectors

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.4.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of SLC, and NAC.

b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.

g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.

h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.

i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.

j. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.

k. The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.

l. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

m. Zones for SLC and NAC shall be arranged as indicated on the contract drawings.

n. Supervisory signal sent on Mass Notification System override of fire alarm evacuation signal.

1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

a. Transmission of signals over the station radio fire reporting system.

b. Visual indications of the alarmed devices on the fire alarm control panel display and on the remote audible/visual display.

c. Continuous sounding or operation of alarm notification appliances throughout the building as required by ANSI S3.41.

d. Closure of doors held open by door closers.

e. Operation of the smoke control system.

f. Deactivation of the air handling units throughout the building.

1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, Mass Notification System, etc.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

(1) Identification of programmable portions of system equipment and capabilities.

(2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

(3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system. Spare parts, manuals for fire alarm system, documentation showing mapping/tree of devices (showing the polling sequence), and all software/hardware required for programming/editing shall be turned over to Public Works personnel at the time of acceptance testing. Spare parts will include 2% or a minimum of 2 each type of device used in the system (bases, sounder bases, modules, detectors, pullstations, hornstrobes, magnetic door holders, etc.). For software-based systems, a record copy of the site-specific software will be delivered DPW Fire Alarm Techs. after all changes have been made for acceptance test.

(4) Description of Fire Alarm Control Panel equipment operation.

(5) Description of auxiliary and remote equipment operations.

(6) Library of application software.

(7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.2 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.1.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.1.4 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Style D initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm, trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-acid type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located in a separate battery cabinet. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18

Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on semi-flush mounted outlet boxes. Manual stations shall be mounted at 1220 mm. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the mounting surface. Surface mount back-boxes shall be the fire alarm system manufacturer's catalog product matched in size, color, and shape to fully support the devices mounted on them. Standard electrical device boxes (sheet metal boxes with knock-outs) shall not be acceptable for surface mount application. Dimensions of back-boxes for surface mount application shall match the dimensions of the initiating devices or notification appliances mounted on them; over-hang shall not be acceptable.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided IAQ NFPA 72. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by fixed temperature or combination fixed temperature and rate-of-rise principle. Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only and shall be of weatherproof construction. The UL 521 test rating for the fixed temperature portion shall be 57.2 degrees C. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 15 by 15 m.

2.5.1.2 Fixed Temperature Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 90 degrees C. The UL 521 test rating for the fixed temperature detectors shall be rated for 4.57 by 4.57 m.

2.5.2 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.5.2.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.2.2 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm

condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 1.83 m and those mounted below 1.83 m that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 15910 DIRECT DIGITAL CONTROL (DDC) SYSTEMS. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red. Surface mount back-boxes shall be the fire alarm system manufacturer's catalog product matched in size, color, and shape to fully support the devices mounted on them. Standard electrical device boxes (sheet metal boxes with knock-outs) shall not be acceptable for surface mount application. Dimensions of back-boxes for surface mount application shall match the dimensions of the initiating devices or notification appliances mounted on them; over-hang shall not be acceptable.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 95 dBA at 3.05 m. Mini audible horns shall produce a sound rating of at least 95dBA at 3.05m. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.6.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and candela ratings as shown. Strobe shall be semi-flush mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Electromagnetic Door Hold-Open Devices

Devices shall be attached to the walls unless otherwise indicated. Devices shall comply with the appropriate requirements of UL 228. Devices shall operate on 24 Volt dc power. Compatible magnetic component shall be attached to the door. Under normal conditions, the magnets shall attract and hold the doors open. When magnets are de-energized, they shall release the doors. Magnets shall have a holding force of 111.2 N (25 pounds). Devices shall be UL or FM approved. Housing for devices shall be brushed aluminum or stainless steel. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure.

2.7.2 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.3 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 14 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.

2.7.4 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of device (bases, sounder bases, modules, detectors, pullstations, hornstrobes, (etc.). For software-based systems, a record copy of the site-specific software will be delivered DPW Fire Alarm Techs. after all changes have been made for acceptance test. , but no less than two each, shall be furnished. All specialized equipment and/or training to program, edit existing program, add or delete devices, etc. shall be provided as apart of the fire alarm system. Systems that require factory certification to process or use their software shall include this training. Spare fuses shall be mounted in the fire alarm panel.

2.8 TRANSMITTERS

2.8.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is King Fisher (www.kfco.com) and the transceiver shall be fully compatible with this equipment. At the contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel.

2.8.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.8.1.2 Radio Alarm Transmitter Housing

Transmitter housing shall be NEMA Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Radio alarm transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.8.1.3 Antenna

The Contractor shall provide directional, coaxial, yagi antennas for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities of 161 km/h. Antennas shall not be mounted to any portion of the building roofing system.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm nor more than 2000 mm above the finished floor. Manually operable controls shall be between 900 and 1100 mm above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.1.5 Notification Appliances

Notification appliances shall be mounted 2300 mm above the finished floor or 150 mm below the ceiling, whichever is lower.

3.1.6 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, and as indicated on the drawings and as specified herein.

3.1.7 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. Label module with device address and function. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in Section 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 SUPERVISING STATION PROVISIONS

3.4.1 Revisions to Existing Facilities

Existing supervising components shall be modified as indicated on the drawings and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been degraded and that the revised configuration plus interfacing components operates compatibly with the new fire alarm system at the protected premises. Work on existing equipment shall be performed in accordance with the manufacturer's instructions or under supervision of the manufacturer's representative.

3.5 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Provide updated as-built fire alarm system plans to DPW Fire Alarm Techs at least 10 days before acceptance test, for their review prior to the acceptance and for use during the acceptance test. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.5.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.5.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

3.6 TRAINING

Necessary factory training shall be furnished by the Contractor to include air fare, lodging, and school fees. The training course shall be provided for 2 members of the operations and maintenance staff. The course shall be conducted at the system's manufacturer's facility, in the building where the system is installed, or as designated by the Contracting Officer. The training period for systems operation shall consist of at least 1 training day (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least 1 training day (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

SECTION 13930

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 2000	(2003) Rubber Products in Automotive Applications

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	(2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1999) Disinfecting Water Mains
AWWA C652	(2002) Disinfection of Water-Storage Facilities
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM P7825b	(2003) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 13R	(1999) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 1963	(1998) Fire Hose Connections
NFPA 24	(2002) Installation of Private Fire Service Mains and Their Appurtenances

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2003) Building Materials Directory
UL Fire Prot Dir	(2004) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building, unless indicated otherwise. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13 and UFC 3-600-01. Design area reduction by use of quick-response sprinklers shall not be permitted. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and

equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein. All designs shall have approval by the Authority Having Jurisdiction (Fort Lewis Fire Department).

1.2.1 Hydraulic Design

For Light Hazard Occupancies, the system shall be hydraulically designed to discharge a minimum density of 4.1 L/min per square meter over the hydraulically most demanding 280 square meters of floor area. For Ordinary Hazard Group 1 Occupancies, the system shall be hydraulically designed to discharge a minimum density of 6.1 L/min per square meter over the hydraulically most demanding 280 square meters of floor area. For Ordinary Hazard Group 2 Occupancies, the system shall be hydraulically designed to discharge a minimum density of 8.2 L/min per square meter over the hydraulically most demanding 280 square meters of floor area. Area reduction will not be allowed for the use of quick-response sprinklers. The minimum pipe size for branch lines in gridded systems shall be 32 mm . Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s .

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 946, 1893, and 1893 L/min for Light Hazard, Ordinary Group 1, and Ordinary Group 2 Occupancies, respectively, shall be added to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supplies with static pressures as follows:

Alpha Block at A Street and 41st Division Drive: Static Pressure -- 503 kPa; Flow -- 4626 lpm at residual pressure of 365 kPa.

Echo Block at D Street and East Drive: Static Pressure -- 538 kPa; Flow -- 4920 lpm at residual pressure of 414 kPa.

NOTE: Contractor shall verify fire flow conditions (static rest pressure, residual pressure and flow) prior to performing hydraulic calculations. The above data is only current as of October 2004.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 9 square m for extra hazard occupancies, 12 square m for ordinary hazard occupancies, and 21 square m for light hazard occupancies. Exceptions are as follows:

1) Facilities that are designed in accordance with NFPA 13R.

2) Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage. In general, but especially in crowded locations such as attic spaces, contractor subs shall coordinate layout of multiple discipline's utilities. Routing and installation of sprinkler pipe shall take place only after adjacent building utilites have also been routed.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G.

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

As-Built Drawings

As-built shop drawings, at most 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be stored on both reproducible full-size mylar film and digital media.

SD-03 Product Data

Fire Protection Related Submittals

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Sway Bracing; G

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Materials and Equipment; G

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts

Spare parts data shall be included for each different item of material and equipment specified.

Preliminary Tests; G

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin the preliminary tests.

Final Acceptance Test; G

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training; G

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Test of Backflow Prevention Assemblies; G.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests. The original, signed Form 13930-BPA-Form and an electronic copy of the completed form shall be provided.

Preliminary Test Report; G

Three copies of the completed Preliminary Test Report, no later that 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G

Three copies of the completed Final Acceptance Tests Reports, no later that 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Manuals shall feature all relevant engineering units in both English and Metric units. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III or IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.11 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.12 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or

ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 150 mm above the floor to a point 1500 mm outside the building wall shall be ductile iron with a rated working pressure of 1034 kPa conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510 WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are

shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4.4 Builing Entrance

Building entrance shall be designed and provided by the Fire Protection Specialist. Contractor shall provide thrust restraint in accordance with the Ductile Iron Pipe Research Association (DIPRA). Restraint rods or thrust blocks shall be provided as required; building entrance penetrations shall be provided with suitable waterproof mastic or similar sealant.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel or copper.

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer;segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be

non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type.

2.5.2 Copper Tube Components

2.5.2.1 Copper Tube

Copper tube shall conform to ASTM B 88M, Types L and M.

2.5.2.2 Copper Fittings and Joints

Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75M. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.5.3 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported. Pipe hangars shall be designed and provided by the Fire Protection Specialist.

2.5.4 Valves

2.5.4.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.5.4.2 Check Valves

Check valves 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.6 ALARM CHECK VALVE ASSEMBLY

Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other

components as required for a fully operational system.

2.7 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

2.8 ALARM INITIATING AND SUPERVISORY DEVICES

2.8.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.8.2 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 15 mm NPT male pipe thread. The switch shall have a maximum service pressure rating of 1207 kPa. There shall be two SPDT (Form C) contacts factory adjusted to operate at 28 to 55 kPa. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

2.8.3 Valve Supervisory (Tamper) Switch

All system valves shall have tamper switches. Switches shall be suitable for mounting to the type of control valve to be supervised open. The switches shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.9 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting or flush type, as indicated, with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Provide 25-76mm (1-3 inches) suitable waterproof mastic at wall penetration. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.10 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary, unless indicated otherwise. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used.

2.10.1 Concealed Sprinkler

Provide concealed sprinklers in all corridors, vestibues, and lobbies.Concealed sprinkler shall be quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice. Concealed sprinkler cover plate shall be white and flush with the adjacent surface.

2.10.2 Recessed Sprinkler

Provide recessed sprinklers in all occupied spaces not provided with concealed sprinklers. Recessed sprinklers shall be white polyester. Recessed sprinkler shall be quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.10.3 Flush Sprinkler

Flush sprinkler shall be chrome-plated quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.10.4 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type with nominal 12.7 mm or 13.5 mm orifice. Pendent sprinklers shall have a polished chrome finish.

2.10.5 Upright Sprinkler

Upright sprinkler shall be chrome-plated quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice. Upright sprinklers in exposed areas may be brass.

2.10.6 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 12.7 mm orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.11 DISINFECTING MATERIALS

2.11.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.11.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.12 ACCESSORIES

2.12.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.12.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.12.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.12.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in the mechanical room, mezzanine, and any chair or furniture storage areas, including beneath the Activity Center platform.

2.12.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.13 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1034 kPa The maximum pressure loss shall be 40 kPa at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves. See Plumbing Schedule for further detail.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests (along with the Fort Lewis Fire Department), and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers

shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in

elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm(.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Locate test connection at riser with UL listed site glass flow device, a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping or to an adequately sized drain that will handle discharge during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13. All drain valves shall have plugs. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 900 mm. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm outside the building walls shall meet the requirements of Section 02510 WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02300 EARTHWORK.

3.7 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. All wiring for supervisory and alarm circuits shall be #14 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.8 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a

minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system. Flushing and testing shall be performed in the presence of a representative of the Fort Lewis Fire Department.

3.9 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.10 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Preliminary tests shall be performed in the presence of a representative of the Fort Lewis Fire Department. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.10.1 Underground Piping

3.10.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system. Underground pipe flushing shall be performed in the presence of a representative of the Fort Lewis Fire Department.

3.10.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2 Aboveground Piping

3.10.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.10.2.2 Test of Backflow Prevention Assemblies

Backflow prevention assemblies shall be tested by a Washington State certified backflow prevention assembly tester. The tester shall complete the attached form (13930-BPA-Form) and shall submit the original signed form, plus a copy of the completed form in electronic format. Backflow prevention assemblies shall be installed by certified, licensed installers. No reduced pressure type backflow prevention assemblies are to be used. Installation of backflow prevention assemblies shall include flushing.

3.10.2.3 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall also be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including65 mm diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.10.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.10.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.11 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. Final Acceptance Test shall be performed in the presence of

a representative of the Fort Lewis Fire Department. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the Fire Protection Specialist shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The Contractor shall submit the Final Acceptance Test Report as specified in the Submittals paragraph.

3.12 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 16 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

BACKFLOW PREVENTION ASSEMBLY (BPA) TEST REPORT
FORT LEWIS, WASHINGTON

BUILDING NUMBER (FROM DRAWINGS): _____ ROOM NUMBER (FROM DRAWINGS): _____

IDENTIFICATION CODE (FROM DRAWINGS): _____

SIZE OF LINE: _____ TYPE OF LINE: _____

EQUIPMENT SERVICED: _____

BPA MANUFACTURER: _____ BPA MODEL: _____

BPA SERIAL NUMBER: _____ BPA SIZE: _____

TYPE OF BPA: _____ PRESSURE @ TIME OF TEST: _____

	Reduced Pressure Backflow Assemblies (RPBAs)			Pressure Vacuum Breaker Assemblies (PVBAs)	
	Double Check Valve Assemblies (DCVAs)		Relief Valve	Air Inlet	Check Valve
	1st CHECK	2nd CHECK	Opened at psid _____	Opened at _____ psid	_____ psid
Initial Test	DC-closed tight ☐ RP- psid _____ Leaked..... ☐	Closed tight.... ☐ Leaked..... ☐	Opened at _____ psid	Did not open ..... ☐	Leaked..... ☐
Repairs and Materials Used					
Test After Repairs	DC-closed tight Rp-_____ psid ☐	Closed tight..... ☐	Opened at _____ psid	Opened at _____ psid	_____ psid

REMARKS: _____

_____

_____

_____

Form 13930-BPA-Form

CONTRACTOR: _____ CONTRACT NUMBER: _____

TESTER NAME: _____ TESTER CERT. NUMBER: _____

TESTER SIGNATURE: _____ _____

SIGNATURE ABOVE CERTIFIES TEST WERE DONE IN CONFORMANCE WITH RECOMMENDATIONS PUBLISHED IN THE AWWA CROSS CONNECTION CONTROL MANUAL

TEST DATE

SECTION 13965

WET CHEMICAL FIRE EXTINGUISHING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM P7825b	(2003) Approval Guide Electrical Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 17A	(2002) Wet Chemical Extinguishing Systems

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir	(2004) Fire Protection Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wet Chemical Fire Extinguishing System; G

Drawings consisting of system layout including assembly and installation details and electrical connection diagrams; piping layout showing pipe sizes, lengths, and supports. Drawings shall include any information required to demonstrate that the system has been coordinated and will function as intended and shall show system relationship to items it protects and clearances required for operation and maintenance. Drawings shall also include conduit, cables, manual actuation stations and fusible links.

SD-03 Product Data

Similar Services

A statement of qualifications as specified.

Wet Chemical Fire Extinguishing System; G

Manufacturer's catalog data including detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration and shall be adequate to demonstrate compliance with contract requirements.

a. Storage containers and mounting brackets

b. Fusible links, cables, conduit, corner pulleys, and link mounting frames/brackets

c. Release mechanisms

d. Valves

e. Discharge nozzles

f. Piping components

g. Remote manual actuation stations

h. Fuel and power shutoff

i. Alarms, alarm devices, alarm interface(s), control panels

Preliminary Tests; G

Proposed test procedures for preliminary test, at least 2 weeks before the start of related testing. System diagrams that show system layout and typed condensed normal and emergency operating procedures, methods for checking the system for normal, safe operation, and procedures for manual actuation shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Final Acceptance Tests; G

Proposed test procedures for final acceptance test, at least 2 weeks before the start of related testing. Proposed test schedule for acceptance test, at least 2 weeks before the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks before the start of related training.

SD-06 Test Reports

Preliminary Tests

Test report for the preliminary tests in booklet form, upon

completion of testing. Report shall document test results including repairs and adjustments made, and final test results.

Final Acceptance Tests

Test report for the final acceptance tests in booklet form, upon completion of testing. Report shall document test results including repairs and adjustments made, and final test results. The weight of each storage container shall be recorded before final acceptance test and after test has been completed and containers recharged.

SD-07 Certificates

Installation Technician; G

Concurrent with statement of similar services, manufacturer's certification of installation technician.

Installation Drawings; G

Concurrent with installation drawings, manufacturer's certification of installation drawings.

SD-10 Operation and Maintenance Data

Wet Chemical Fire Extinguishing System

Six manuals listing step-by-step procedures required for system actuation (automatic and manual), recharging, and routine maintenance, at least 2 weeks before field training. The manuals shall include the manufacturer's name, model number, parts list, list of tools and parts that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number). Manuals shall feature all relevant engineering units in both English and Metric units. Service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.3 GENERAL REQUIREMENTS

1.3.1 System Description

Each range top shall be protected by a preengineered wet chemical fire extinguishing system. System shall be installed with all accessories necessary for system to operate in accordance with manufacturer's instructions and as specified herein.

1.3.2 Regulatory Requirements

System application, design, and installation shall comply with NFPA 17A. System components shall be listed in UL Fire Prot Dir or approved by FM

P7825a and FM P7825b for use with wet chemical fire extinguishing systems.

1.3.3 Installation Drawings

Installation drawings shall be prepared by a representative of the manufacturer to ensure compliance with the requirements listed herein and with all manufacturer's requirements and recommendations.

1.3.4 Installation Technician

The installation technician shall have been trained by the system manufacturer for system installation, operation, and maintenance.

1.4 COORDINATION OF TRADES

Each system shall be coordinated with the equipment, hood, and exhaust ducts that it protects along with other construction in order to eliminate any interference.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

Wet chemical fire extinguishing system for residential range hoods shall bemanufactured by a single source. All equipment shall perform as a single system. The system design shall conform to the UL listing as tested. The system shall be capable of detecting a cooking fire originating on the range top, extinguish the fire, and shut off the electric supply to the range top. Minimum capacity of wet chemical shall be 3 lbs. Nozzles and piping shall be located under the hood. Wet chemical tank shall be located within a cabinet or otherwise out of sight.

2.1 STANDARD PRODUCTS

System components shall be the standard products of a manufacturer regularly engaged in the manufacturing of products that are of similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include installations of systems under similar circumstances and of similar size. Systems shall be supported by a service organization.

2.2 SYSTEM CONTROLS

Each system shall be actuated by fusible link or temp sensor, and by a remote manual actuation station connected to the extinguishing system release mechanism by cable. Remote manual actuation stations shall be located along the path of egress and shall automatically actuate the building fire alarm system. The system controls shall automatically shut

off fuel flow and electrical power to the protected appliances and other appliances located under the ventilating system protected by the extinguishing system upon system actuation. All cables used shall be stainless steel with corner pulleys employing stainless steel ball bearings at all corners. All cable and wiring shall be enclosed in conduit.

2.3 WET CHEMICAL

The wet chemical shall not have an adverse effect on stainless steel during exposure periods of up to 24 hours.

2.4 IDENTIFICATION SIGNS

Identification signs shall be located at each remote manual actuation station. Signs shall be fabricated of rigid plastic, red in color, with engraved white letters that are a minimum 6.5 mm inches) in height. Each sign shall be engraved with "Fire Extinguishing System" and with a brief description of the equipment protected.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be performed by the installation technician in accordance with system manufacturer's instructions. Ductwork access doors shall be provided where indicated and at any items requiring service and inspection, including nozzles and fusible links. Ductwork access doors shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.2 FINAL ACCEPTANCE TESTS

System shall be actuated by both fusible link and remote manual actuation station and all system functions shall be verified; actual system containers fully charged with wet chemical shall be used. Each nozzle shall be provided with a plastic container, hose, and hose fitting to capture all wet chemical discharged. All tests or checks recommended by the manufacturer shall also be performed. In the event portions of the tests are unsuccessful, repairs shall be made and the entire test repeated until successful. Nozzle seals/covers shall be replaced after the final acceptance tests are complete. The system shall be returned to normal operating condition after the completion of testing and wet chemical containers expended shall be recharged and verified leak tight. Extinguishing system and equipment and duct protected by the extinguishing shall be cleaned after completion of testing. Any damage shall be repaired by the Contractor. The weight of each storage container shall be recorded before final acceptance test and after test has been completed and containers recharged.

3.3 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 2 hours of normal working time and shall

start after the system is functionally complete and after the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved Operation and Maintenance Instructions.

-- End of Section --

SECTION 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Seismic Restraint Mnl	(1998) Seismic Restraint Manual Guidelines for Mechanical Systems

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.2.2 Mechanical Equipment

Mechanical equipment to be seismically protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

Field-built Heat Pumps	Storage Tanks for Water
Water Heaters	Water and Gas Piping
Expansion Tanks	Valves and Fittings for Piping
Hydropneumatic Tanks	Air Handling Units
Terminal Units	Fan Coil Units
Pumps with Motors	Ducts
Unit Heaters	Exhaust and Return Fans
Air Separators	Heat Recovery Units

1.2.3 Mechanical Systems

The following mechanical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building Except as Specifically Stated Below Under "Items Not Covered By This Section".
Fuel Piping Outside of Buildings
All Water Supply Systems
Storm and Sanitary Sewer Systems

1.2.4 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. TI 809-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using TI 809-04 are based on strength design; therefore, AISC 325 Specifications shall be used for the design. The bracing for all mechanical equipment and systems shall be developed by the Contractor.

1.2.5 Items Not Covered By This Section

1.2.5.1 Fire Protection Systems

Seismic protection of piping for fire protection systems shall be installed as specified in Section 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION.

1.2.5.2 Items Requiring No Seismic Restraints

Seismic restraints are not required for the following items:

a. Gas piping less than 25 mm inside diameter.

b. Piping in boiler and mechanical equipment rooms less than 32 mm inside diameter.

c. All other piping less than 64 mm inside diameter.

d. Rectangular air handling ducts less than 0.56 square meters in cross sectional area.

e. Round air handling ducts less than 711 mm in diameter.

f. Piping suspended by individual hangers 300 mm or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.

g. Ducts suspended by hangers 300 mm or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions f. and g. all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced. Interior piping and ducts not listed above shall be seismically protected in accordance with the provisions of this specification.

1.3 EQUIPMENT REQUIREMENTS

1.3.1 Rigidly Mounted Equipment

The following specific items of equipment listed below to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in TI 809-04, Chapter 10. Each item of rigid equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, duct, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

Heat Exchangers
Ground floor-mounted Air-Handling Units
Hydropneumatic Tanks
Water Heaters

1.3.2 Nonrigid or Flexibly-Mounted Equipment

The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 1.25 times the operating weight of the equipment at the vertical center of gravity of the equipment.

Air-Handling Units (Mezzanine mounted or otherwise not ground floor-mounted)
Exhaust Fans
Terminal Units
Unit Heaters
Heat Pumps
Heat Recovery Units
Heat Exchangers
Water Recirc Pumps

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Coupling and Bracing
Flexible Couplings or Joints
Equipment Requirements
Contractor Designed Bracing; G

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Coupling and Bracing; G
Equipment Requirements; G

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

Contractor Designed Bracing; G

Copies of the design calculations with the drawings. Calculations shall be approved, certified, stamped and signed by a registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-07 Certificates

Flexible Ball Joints

Flexible ball joints shall be certified to be suitable for the service intended by the manufacturer. Information verifying experience at not less than 3 locations of 2 years' satisfactory operation in a similar application shall be submitted.

PART 2 PRODUCTS

2.1 FLEXIBLE COUPLINGS

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

2.2 FLEXIBLE BALL JOINTS

Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation with not less than 15-degree angular movement.

2.3 FLEXIBLE MECHANICAL JOINTS

a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets.

2.4 MANUFACTURED BALL JOINTS

Manufactured ball joints shall be as recommended by the manufacturer for the intended use, and shall be approved by the Contracting Officer before installation.

2.5 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

3.1 COUPLING AND BRACING

Coupling installation shall conform to the details shown on the drawings. Provisions of this paragraph apply to all piping within a 1.5 m line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the most frequent interval as determined by applying the requirements of this sepcification to each piping run on the common support. Bracing components shall be sized as required for the total load carried by the common supports. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Joints capable of accommodating seismic displacements shall be provided for pipes passing through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. Horizontal piping across expansion joints shall accommodate the resultant of the drifts of each building unit in each orthogonal direction. For threaded piping, swing joints made of the same piping material shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 meters per meter of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers for pipe larger than 90 mm in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to satisfy these requirements.

3.3.2 Underground Piping

Underground piping and 100 mm or larger conduit shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 76 mm of relative movement between the pipe and the building in any direction. Additional flexible couplings shall be provided where shown on the drawings.

3.4 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve. Pipe sleeves in fire rated walls shall conform to the requirements in Section 07840 FIRESTOPPING.

3.5 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 100 mm apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

3.6.1 Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT. All runs (length of pipe between end joints) shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other

than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.6.2 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 12 m intervals unless otherwise indicated. All runs (length of pipe between end joints) shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.6.3 Vertical Runs

Run is defined as length of pipe between end joints. Vertical runs of piping shall be braced at not more than 3 m vertical intervals. Braces for vertical runs shall be above the center of gravity of the segment being braced. All sway braces shall be constructed in accordance with the drawings. Sway braces shall not be connected to branch lines, walls, or floors.

3.6.4 Clamps and Hangers

Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.7 SWAY BRACES FOR DUCTS

3.7.1 Braced Ducts

Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA Seismic Restraint Mnl, including Appendix E. However, the design seismic loadings for these items shall not be less than loadings obtained using the procedures in TI 809-04.

3.7.2 Unbraced Ducts

Hangers for unbraced ducts shall be attached to the duct within 50 mm of the top of the duct with a minimum of two #10 sheet metal screwsand in accordance with SMACNA Seismic Restraint Mnl. Unbraced ducts shall be installed with a 150 mm minimum clearance to vertical ceiling hanger wires.

-- End of Section --

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SECTION 15080

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 1126	(2000) Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C 1136	(1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1290	(2000e1) Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2000) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(1995; R 2001) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2001a) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2000) Mineral Fiber Pipe Insulation

ASTM C 552	(2000e1) Cellular Glass Thermal Insulation
ASTM C 553	(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 610	(1999) Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1995; R 2000) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(2002) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(1992; R 1998el) Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 1996el) Adhesives for Duct Thermal Insulation
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM C 921	(1989; R 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 882	(1997) Tensile Properties of Thin Plastic Sheeting
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial

Insulation Standards

1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread, and smoke developed indexes, shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

MICA Plates

After approval of materials and prior to applying insulation, a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA Insulation Stds plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment that must be insulated per this specification. The MICA plates shall be marked up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label that identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

SD-03 Product Data

General Materials

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

SD-04 Samples

Thermal Insulation Materials

After approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements, shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the

construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I.

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a flame spread rating no

higher than 25 and a smoke developed rating no higher than 50 when tested in accordance with ASTM E 84. Adhesive shall be pigmented red and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding fibrous glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesives may be dispersed in a volatile organic solvent. Adhesives may be any of, but not limited to, the neoprane based, rubber based, or elastomeric type that have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in the dry state in accordance with ASTM E 84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 100 degrees C The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.4060 mm aluminum 25 x 25 mm with factory applied kraft backing. Aluminum shall be ASTM B 209M, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

ASTM C 449/C 449M: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must include testing per ASTM C 795.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Tape shall be 100 mm wide rolls.

2.1.7 Staples

Outward clinching type monel or ASTM A 167, Type 304 or 316 stainless steel. Monel is a nickel rich alloy that has high strength, high ductility, and excellent resistance to corrosion.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, (measured before factory application or installation), minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 6.1 N/mm width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 3.5 N/mm width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber and phenolic foam. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.1.8.1 White Vapor Retarder All Service Jacket (ASJ)

For use on hot/cold pipes, ducts, or equipment vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.4060 mm nominal thickness; ASTM B 209M, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.3960 mm thick, 12.7 mm wide for pipe under 300 mm diameter and 19.1 mm (3/4 inch) wide for pipe over 300 mm diameter. Aluminum jacket circumferential seam bands shall be 50.8 x 0.4060 mm aluminum matching jacket material. Bands for insulation below ground shall be 19.1 x 0.5080 mm thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburg or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.7620 mm

2.1.9 Vapor Retarder Required

2.1.9.1 Vapor Retarder Mastic Coatings

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined

according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C 647.

2.1.9.2 Laminated Film Vapor Retarder

ASTM C 1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.9.3 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 5.3 kN/m when tested per ASTM D 882, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

2.1.9.4 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for PVDC Film Vapor Retarder.

2.1.10 Vapor Retarder Not Required

ASTM C 1136, Type III, maximum moisture vapor transmission 0.10 perms, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable.

2.1.11 Wire

Soft annealed ASTM A 580/A 580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.1.12 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

2.2 PIPE INSULATION MATERIALS

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 34 degrees to plus 16 degrees C for outdoor, indoor, exposed or concealed applications, shall be as follows:

a. Deleted.

b. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.

c. Phenolic Insulation: ASTM C 1126, Type III. Phenolic insulations shall comply with ASTM C 795 and with the ASTM C 665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Polyisocyanurate Insulation: ASTM C 591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder.

2.2.2 Aboveground Hot Pipeline

Insulation for above 16 degrees C, for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket.

a. Mineral Fiber: ASTM C 547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

b. Deleted.

c. Deleted.

d. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II to 93 degrees C service.

e. Phenolic Insulation: ASTM C 1126 Type III to 121 C service shall comply with ASTM C 795. Supply the insulation with manufacturer's recommended factory-applied jacket.

f. Perlite Insulation: ASTM C 610

g. Polyisocyanurate Insulation: ASTM C 591, Type 1, to 149 degrees C service. Supply the insulation with manufacturer's recommended factory applied jacket.

2.2.3 Below-ground Pipeline Insulation

For below-ground pipeline insulation the following requirements shall be met.

2.2.3.1 Cellular Glass

ASTM C 552, type II.

2.2.3.2 Polyisocyanurate

ASTM C 591, Type 1, to 149 degrees C.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, & IV.

2.3.2 Flexible Mineral Fiber

ASTM C 553: Type I,or Type II up to 121 C. ASTM C 1290 Type III.

2.3.3 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.3.4 Flexible Elastomeric Cellular

ASTM C 534: Type II.

2.3.5 Polyisocyanurate

ASTM C 591: Type 1. Supply the insulation with manufacturer's recommended factory-applied jacket.

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.4.1 Cold Equipment Insulation

For equipment operating temperatures below 16 degrees C

2.4.1.1 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II.

2.4.1.2 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.4.1.3 Polyisocyanurate Foam

ASTM C 591, Type I. Supply the insulation with manufacturer's factory-applied jacket.

2.4.2 Hot Equipment Insulation

For equipment operating temperatures above 16 degrees C

2.4.2.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, IV, or V as required for temperatures encountered to 982 degrees C

2.4.2.2 Flexible Mineral Fiber

ASTM C 553: Type I, II, III, IV, V, VI or VII as required for temperatures encountered to 649 degrees C

2.4.2.3 Calcium Silicate

ASTM C 533, Type I, in-doors only, or outdoors above 121 degrees C

2.4.2.4 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II, to 93 degrees C

2.4.2.5 Phenolic Foam

ASTM C 1126, Type II, to 121 degrees C shall comply with ASTM C 795.

2.4.2.6 Molded Expanded Perlite

ASTM C 610.

2.4.2.7 Polyisocyanurate Foam:

ASTM C 591, Type I to 149 degrees C service. Supply the insulation with manufacturer's recommended factory-applied jacket.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall

be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Fire-stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840 FIRESTOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTS AND COATINGS.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 93 degrees C. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket shall extend 50 mm beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 250 mm above the floor with one band at the floor and one not more than 25 mm from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 50 mmabove the flashing with a band 25 mm from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 50 mm beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 50 mm down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 2.0 mm applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 50.0 mm and shall seal the end of the insulation. Glass tape seams shall overlap 25 mm. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall

penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 10 mm.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 2.0 mm. The coating shall extend out onto the insulation 50 mm and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 10 mm.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 50 mm and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 50 mm shall be installed.

b. Horizontal pipes larger than 50 mm at 16 degrees C and above shall be supported on hangers in accordance with MSS SP-69, and Section 15400 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 50 mm and below 16 degrees C shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, calcium silicate (or perlite above 27 C), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The

insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 9 m, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 38 mm, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C 1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 150 mm and less. Type II sheet insulation used on pipes larger than 150 mm shall not be stretched around the pipe. On pipes larger than 300 mm, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms and mechanical rooms, welded PVC, stainless steel, or aluminum jackets shall be utilized. Pipe insulation to the 1.8 m level shall be protected.

3.2.2 Aboveground Cold Pipelines

The following cold pipelines shall be insulated per Table I minus 34 degrees C to plus 16 degrees C

a. Domestic cold water (including non-potable).

b. Make-up water.

c. Horizontal and vertical portions of interior roof drains.

d. Refrigerant suction lines.

e. Deleted.

f. Dual temperature water, i.e. HVAC hot/chilled water.

g. Air conditioner condensate drains.

h. Heat pump water supply loops (source and load sides).

i. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness
Pipe Size (mm)

Type of Service	Material	Run-outs up to 50 mm*	25 mm & less	30 50 mm	65 - 100 mm	125 - 150 mm	205 mm & larger
Refrigerant suction piping	FC		25	25	25	25	25
	PF		40	40	40	40	40
	PC		25	25	25	25	25
Chilled water supply & return & dual temp piping	CG	40	40	40	50	50	50
	FC	10	25	25	25	25	25
	PF	40	40	40	40	40	40
	PC	25	25	25	25	25	25
Cold domestic water, above and below ceilings, & make up water	FC	10	10	10	10	10	10
	PF	40	40	40	40	40	40
	PC	25	25	25	25	25	25
Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap personnel	FC	15	15	15	15	20	20
	MF	15	25	25	40	40	40
Horizontal & vertical	FC		15	15	15	15	15
	PF		40	40	40	40	40

Table I - Cold Piping Insulation Thickness
Pipe Size (mm)

Type of Service	Material	Run-outs up to 50 mm*	25 mm & less	30 50 mm	65 - 100 mm	125 - 150 mm	205 mm & larger
roof drain leaders (including underside of roof drain fitting)	PC		25	25	25	25	25
Air conditioning condensate drain located inside building	FC		10	15	15	N/A	N/A
	PF		40	40	40	N/A	N/A
	PC		25	25	25	N/A	N/A

*When run-outs to terminal units exceed 3.66 m the entire length of run-out shall be insulated like the main feed pipe. Insulations may not be applied if their flame and smoke developed ratings exceed the requirements of 25/50 established in this guide specification. Layered insulations, or installation where multiple layers of the same insulation are used, must be checked for this (in particular if the insulation has been rated per ASTM E 84 for one thickness).

LEGEND:

PF - Phenolic Foam
MF - Mineral Fiber
FC - Flexible Elastomeric Cellular
PC - Polyisocyanurate Foam

3.2.2.2 Jacket for Mineral Fiber, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building, to be protected with an aluminum jacket, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.8 m level shall be protected.

3.2.2.3 Insulation for Straight Runs (Mineral Fiber, Phenolic Foam and Polyisocyanurate Foam)

a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive

tape.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm (Butt strips 75 mm wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. If staples are used, they shall be sealed per item "e." below.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees and 50 degrees C during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape. The patch shall extend not less than 38 mm past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 50 mm or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 2.0 mm applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. The coating shall extend out onto the adjoining pipe insulation 50 mm. Fabricated insulation with a factory vapor retarder jacket shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 2 mm and with a 50 mm wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 100 mm wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 150 mm from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

The following hot pipelines above 16 degrees C shall be insulated per Table II:

a. Domestic hot water supply & re-circulating system.

b. Deleted.

c. Deleted.

d. Hot water heating.

3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
MF - Mineral Fiber
FC - Flexible Elastomeric Cellular
PL - Perlite
PC - Polyisocyanurate Foam

Table II - Hot Piping Insulation Thickness
Pipe Size (mm)

Type of Service (degrees C)	Material	Run-outs up to 50 mm*	25 mm & less	32 - 50 mm	65 - 100 mm	125 - 150 mm	205 mm & larger
Hot domestic water supply & re-circulating system (93C max)**	CG	40	40	40	40	40	40
	FC	15	25	25	40	40	40
	PF	15	25	25	25	25	25
	MF	15	40	40	40	40	40
	PC	25	25	25	25	25	25
Heating hot water, supply & return (121 C Max)	CG	40	40	50	50	65	80
	PF	15	25	25	25	25	40
	MF	15	40	40	50	65	80
	PL	25	40	50	65	65	80
	PC	25	25	25	25	25	25

* When run-outs to terminal units exceed 3.66 m, the entire length of run-out shall be insulated like the main feed pipe.

** Applied to re-circulating sections of service or domestic hot water systems and first 2.4 meters from storage tank for non-re-circulating systems.

3.2.3.2 Jacket for Insulated Hot Pipe, Except Pipe Insulated with Flexible Elastomeric Cellular

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

a. Insulation shall be applied to the pipe with joints tightly butted.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm, and butt strips 75 mm wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be

omitted where pipe is concealed.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees and 49 degrees C and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is non-adhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. Breaks and punctures in the jacket material shall be patched by either wrapping a strip of jacket material around the pipe and securing with adhesive and staple on 100 mm centers (if not factory self-sealing), or patching with tape and sealing with a brush coat of vapor retarder coating. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 38 mm past the break.

f. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Type II sheet insulation when used on pipe larger than 150 mm shall not be stretched around the pipe. On pipes larger than 300 mm adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.3.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates, except as modified herein: 5 for anchors; 10, 11, 12,and 13 for fittings; 14, 15 and 16 for valves; 17 for flanges and unions; and 18 for couplings. Insulation shall be the same as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 50 mm or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and

insulation not protected by factory jackets or PVC fitting covers shall be protected with two coats of adhesive applied with glass tape embedded between coats. Tape seams shall overlap 25 mm Adhesive shall extend onto the adjoining insulation not less than 50 mm The total dry film thickness shall be not less than 2.0 mm

d. Insulation terminations shall be tapered to unions at a 45-degree angle.

e. At the option of the Contractor, factory pre-molded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory pre-molded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers.

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 50 mm at longitudinal and circumferential joints and shall be secured with bands at not more than 300 mm centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 16 degrees C and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 16 degrees C and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 16 degrees C shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 25 mm and the adjoining aluminum jacket not less than 50 mm Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof.

3.2.4.3 PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.2.5 Below ground Pipe Insulation

The following shall be included:

a. Domestic hot water.

b. Heating hot water.

3.2.5.1 Type of Insulation

Below ground pipe shall be insulated with Cellular Glass insulation, or with Polyisocyanurate insulation, in accordance with manufacturer's instructions for application with thickness as determined from Table I or Table II (whichever is the most restrictive).

3.2.5.2 Installation of Below ground Pipe Insulation

a. Bore surfaces of the insulation shall be coated with a thin coat of gypsum cement of a type recommended by the insulation manufacturer. Coating thickness shall be sufficient to fill surface cells of insulation. Mastic type materials shall not be used for this coating. Note that unless this is for a cyclic application (i.e., one that fluctuates between high and low temperature on a daily process basis) there is no need to bore coat the material.

b. Stainless steel bands, 19 mm wide by 0.5080 mm thick shall be used to secure insulation in place. A minimum of two bands per section of insulation shall be applied. As an alternate, fiberglass reinforced tape may be used to secure insulation on piping up to 300 mm in diameter. A minimum of two bands per section of insulation shall be applied.

c. Insulation shall terminate at anchor blocks but shall be continuous through sleeves and manholes.

d. At point of entry to buildings, underground insulation shall be terminated 50 mm inside the wall or floor, shall butt tightly against the aboveground insulation and the butt joint shall be sealed with high temperature silicone sealant.

e. Provision for expansion and contraction of the insulation system shall be made in accordance with the insulation manufacturer's recommendations.

f. Flanges, couplings, valves, and fittings shall be insulated with factory pre-molded, prefabricated, or field-fabricated sections of insulation of the same material and thickness as the adjoining pipe insulation. Insulation sections shall be secured in place

with wire, the bore surfaces coated, and joints sealed as specified.

g. Insulation, including fittings, shall be finished with three coats of asphaltic mastic, with 6 by 5.5 mesh synthetic reinforcing fabric embedded between coats. Fabric shall be overlapped a minimum of 50 mm at joints. Total film thickness shall be a minimum of 4.7 mm As an alternate, a prefabricated bituminous laminated jacket, reinforced with internal reinforcement mesh, shall be applied to the insulation. Jacketing material and application procedures shall match manufacturer's written instructions.

h. At termination points, other than building entrances, the mastic and cloth or tape shall cover the ends of insulation and extend 50 mm along the bare pipe.

3.3 DUCT INSULATION INSTALLATION

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (mm)

Cold Air Ducts	50
Relief Ducts	40
Fresh Air Intake Ducts	40
Warm Air Ducts	50

Maximum thickness for flexible elastomeric cellular insulation shall not exceed 25 mm, and maximum thickness for polyisocyanurate foam insulation shall not exceed 40 mm to comply with ASTM E 84 flame spread/smoke developed ratings of 25/50.

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil headers and return bends.

h. Coil casings.

i. Fresh air intake ducts.

j. Filter boxes.

k. Mixing boxes (field-insulated).

l. Supply fans (field-insulated).

m. Site-erected air conditioner casings.

n. Ducts exposed to weather.

o. Combustion air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter and rigid type where exposed, minimum density 48 kg per cubic meter Insulation for round/oval ducts shall be flexible type, minimum density 12 kg per cubic meter with a factory Type I or II jacket; or, a semi rigid board, minimum density 48 kg per cubic meter, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I or II all service jacket. Insulation for exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Insulation on concealed duct shall be provided with a factory-applied Type I or II vapor retarder jacket. The total dry film thickness shall be approximately 2.0 mm. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts, 600 mm and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 400 mm centers and not more than 400 mm from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 400 mm centers and not more than 400 mm from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 50 mm The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 50 mm beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 50 mm Pin puncture coatings shall extend 50 mm from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 300 mm apart and not more than 75 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger. One row shall be provided for each side of duct less than 300 mm

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using

mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed or bent over.

d. Joints in the insulation jacket shall be sealed with a 100 mmwide strip of tape. Tape seams shall be sealed with a brush coat of vapor retarder coating.

e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 50 mm Pin puncture coatings shall extend 50 mm from the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 12 kg per cubic meter attached as per MICA standards.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts

c. Relief air ducts

d. Flexible run-outs (field insulated)

e. Plenums

f. Duct-mounted coil casings

g. Coil-headers and return bends

h. Coil casings.

i. Fresh air intake ducts

j. Filter boxes

k. Mixing boxes

l. Supply fans

m. Site-erected air conditioner casings

n. Ducts exposed to weather

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter and rigid type where exposed, minimum density 48 kg per cubic meter Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 12 kg per cubic meter with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 2.0 mm Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts 600 mm and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 50 mm at joints and the lap shall be secured and stapled on 100 mm centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 400 mm apart and not more than 150 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger and a minimum of one row for each side of duct less than 300 mm

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.

d. Joints on jacketed insulation shall be sealed with a 100 mm wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 12 kg per cubic meter attached by staples spaced not more than 400 mmand not more than 150 mm from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be

repaired.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Hand-holes.

b. Boiler manholes.

c. Cleanouts.

d. ASME stamps.

e. Manufacturer's nameplates.

3.4.2 Insulation for Cold Equipment

Cold equipment below 16 degrees C Insulation shall be furnished on equipment handling media below 16 degrees C including the following:

a. Pneumatic water tanks.

b. Roof drain bodies.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

a. Equipment handling media between 2 and 16 degrees C 25 mm thick flexible elastomeric cellular, 40 mm thick phenolic foam, or 25 mm thick polyisocyanurate foam.

3.4.2.2 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 300 mm centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Phenolic foam insulation shall be set in a coating of bedding compound and joints shall be sealed with bedding compound as recommended by the manufacturer. Joints and ends shall be sealed

with joint sealant, and sealed with a vapor retarder coating.

d. Deleted.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 150 x 150 mm by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 x 50 mmwashers or shall be securely banded or wired in place on 300 mm centers.

3.4.2.3 Vapor Retarder

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the coats. The total dry thickness of the finish shall be 2.0 mm Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 16 degrees C including the following:

a. Deleted.

b. Heat exchangers.

c. Deleted.

d. Water heaters.

e. Pumps handling media above 54 degrees C

f. Deleted.

g. Hot water storage tanks.

h. Air separation tanks.

i. Bladder tanks.

3.4.3.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table IV:

Legend

RMF: Rigid Mineral Fiber
FMF: Flexible Mineral Fiber
CS: Calcium Silicate
PL: Perlite
FC: Flexible Elastomeric Cellular
PF: Phenolic Foam
PC: Polyisocyanurate Foam

TABLE IV
Insulation Thickness for Hot Equipment (mm)

Equipment handling steam or other media to indicated pressure or temperature limit	Material	Thickness
103.4 kPa or 121 C	RMF	50 mm
	FMF	50 mm
	CS/PL	100 mm
	PF	40 mm
	FC(<93 C)	25 mm
	PC	25 mm
1379.0kPa or 204 C	RMF	75 mm
	FMF	75 mm
	CS/PL	100 mm
316 C	RMF	125 mm
	FMF	150 mm
	CS/PL	150 mm

>316 C: Thickness necessary to limit the external temperature of the insulation to 50 C. Heat transfer calculations shall be submitted to substantiate insulation and thickness selection.

3.4.3.2 Insulation of Pumps

Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 2.0 mm Caulking shall be applied to parting line

of the removable sections and penetrations.

3.4.3.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 300 mm centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. On high vibration equipment, mineral fiber joints shall be filled with finishing cement.

d. Deleted.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs, such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 150 x 150 mm by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 x 50 mm washers or shall be securely banded or wired in place on 300 mm (maximum) centers.

g. On equipment handling media above 316 degrees C insulation shall be applied in two or more layers with joints staggered.

h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 2.0 mm Caulking shall be applied to parting line between equipment and removable section insulation.

-- End of Section --

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SECTION 15216

WELDING PRESSURE PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(2001) Recommended Practice

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(2001) Standard Welding Terms and Definitions
AWS B2.1	(2000) Welding Procedure and Performance Qualification
AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel
AWS QC1	(1996) AWS Certification of Welding Inspectors
AWS Z49.1	(1999) Safety in Welding, Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME B31.1	(2001) Power Piping
ASME B31.3	(2002) Process Piping
ASME B31.4	(2002) Piping Transportation Systems for Liquid Hydrocarbons and Other Liquid
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B31.9	(1996) Building Services Piping
ASME BPVC SEC II-C	(2001) Boiler and Pressure Vessel Code; Section II, Materials, Part C - Specifications for Welding Rods,

	Electrodes and Filler Metals
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC V	(2001) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

1.2 DEFINITIONS

AWS A3.0 and applicable ANSI piping documents.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Welding pressure piping

SD-07 Certificates

Welding procedures qualification

Nondestructive examination (NDE) procedures

NDE personnel certification procedures

Inspector certification

Submit inspector certification and NDE personnel certification for record.

SD-11 Closeout Submittals

Weld identifications

1.4 QUALITY ASSURANCE

1.4.1 Welding Pressure Piping

Show location, length, and type of welds, and indicate postweld heat treatment and nondestructive testing as required.

1.4.2 Procedures

Develop and qualify procedures for welding metals included in the work. Do not start welding until welding procedures, welders, and welding operators have been qualified. Perform qualification testing by an approved testing laboratory, or by the Contractor if approved by the Contracting Officer in accordance with the qualified procedures. Notify the Contracting Officer at least 24 hours in advance of the time and place of the tests. When practicable, perform the qualification tests at or near the work site. Maintain current records of the test results obtained in welding procedure, welding operator/welder performance qualifications, and nondestructive examination (NDE) procedures. These records shall be readily available at the site for examination by the Contracting Officer.Qualify the procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses. ANSI Piping requirements for branch connections may be used in lieu of detailed designs. Unless otherwise specified, the choice of welding process shall be the responsibility of the Contractor.

1.4.2.1 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for the work without requalification provided that the following conditions are fulfilled:

a. Copies of welding procedures, procedure qualification test records, and welder and welding operator performance qualification test records are submitted and approved in accordance with the paragraph entitled "Submittals."

b. Testing was performed by an approved testing laboratory or technical consultant or by the Contractor's approved quality control organization.

c. The welding procedures, welders, and welding operators were qualified in accordance with ASME BPVC SEC IX or AWS B2.1, AR-2 level; and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of this specification.

d. The requirements of paragraph entitled "Welder and Welding Operator Performance Qualification" for renewal of qualification were met, and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

1.4.2.2 Performance

The Contractor shall be responsible for the quality of joint preparation, welding, and examination. Clearly identify and record materials used in the welding operations. The examination and testing defined in this specification are minimum requirements. Provide additional examination and testing as necessary to achieve the quality required.

1.4.3 Welding Procedures Qualification

Qualification of the welding procedures for each group of materials to be welded is required as indicated in ASME BPVC SEC IX. Record in detail and qualify the "Welding Procedure Specifications" for every welding procedure proposed. Qualification for each welding procedure shall conform to the requirements of ANSI Standards and to this specification. The welding procedures shall specify end preparation for welds, including cleaning, alignments, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by ANSI Piping documents, unless otherwise indicated or specified. Describe the type of backing rings or consumable inserts, if used, and, if they are to be removed, the removal process. Welding procedure qualifications shall be identified individually and referenced on the shop drawings or suitably keyed to the contract drawings.

1.4.4 Welder and Welding Operator Performance Qualification

Qualify each welder and welding operator assigned to work covered by this specification by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires from the same specification, classification, or group number that will be encountered on his assignment. Welders or welding operators who make acceptable procedure qualification tests will be considered performance-qualified for the welding procedure used. Determine performance qualification in accordance with ANSI Piping Standards and as specified.

1.4.5 Renewal of Qualification

Requalification of a welder or welding operator shall be required under one or any combination of the following conditions:

a. When a welder or welding operator has not used the specific welding process for a period of 3 months. The period may be extended to 6 months if the welder has been employed on another welding process.

b. There is specific reason to question the welder's ability to make welds that will meet the requirements of the specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract and a qualification test has not been taken within the preceding 12 months. Renewal of qualification under this condition need be made on only a single test joint or pipe of any thickness, position, or material to reestablish qualification for any thickness, position, or material for which the welder or welding operator had qualified previously.

1.4.6 Qualification of Inspection and (NDE) Personnel

Qualification of Inspection and Nondestructive Examination (NDE) Personnel: Qualify inspection and nondestructive examination personnel in accordance

with the following requirements:

1.4.6.1 Inspector Certification

Qualify welding inspectors in accordance with AWS QC1.

1.4.6.2 NDE Personnel Certification Procedures

Certify NDE personnel and establish a written procedure for the control and administration of NDE personnel training, examination, and certification. Base procedures on appropriate specific and general guidelines of training and experience recommended by ASNT RP SNT-TC-1A.

1.4.6.3 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding procedure specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit their names, together with certification that each individual is performance qualified as specified. Do not start welding work prior to procedure qualification. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.4.7 Symbols

Conform to AWS A2.4.

1.4.7.1 Weld Identifications

Submit a list of the welders' names and symbol for each welder. To identify welds, submit written records indicating the location of welds made by each welder or welding operator.

1.4.8 Safety

Conform to AWS Z49.1, 29 CFR 1910-SUBPART Q, "Welding, Cutting, and Brazing," 29 CFR 1926-SUBPART J, "Welding and Cutting."

1.5 ENVIRONMENTAL

Do not perform welding when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contracting Officer will determine when weather or working conditions are unsuitable for welding.

1.6 DELIVERY AND STORAGE

Deliver filler metals, electrodes, fluxes and other welding materials to the site in manufacturers' original packages and store in a dry space until used. Label and design packages properly to give maximum protection from moisture and to assure safe handling.

PART 2 PRODUCTS

2.1 WELDING MATERIALS

Comply with ASME BPVC SEC II-C. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

PART 3 EXECUTION

3.1 WELDING

Do not deviate from applicable codes, approved procedures and approved shop drawings without prior written approval from the Contracting Officer. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this specification unless otherwise specified. Assign each welder or welding operator an identifying number, letter, or symbol that shall be used to identify his welds. Each welder or welding operator shall apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal. For seam welds, place identification marks adjacent to the welds at one meter intervals. Confine identification by die stamps or electric etchers to the weld reinforcing crown, preferably in the finished crater.

3.2 WELDING OPERATORS

Perform welding in accordance with qualified procedures using qualified welders and welding operators.

3.3 SUPPORTS

Welding of hangers, supports, and plates to structural members shall conform to AWS D1.1/D1.1M.

3.4 EXAMINATIONS AND TESTS

Visual and nondestructive examinations shall be performed by the Contractor to detect surface and internal discontinuities in completed welds. Visually examine welds Liquid penetrant, Magnetic particle, or Ultrasonic examination shall be required as indicated in Table IV attached to this section or in accordance with other sections where detailed requirements are specified. Random NDE testing applies to ASME B31.3 and ASME B31.4 piping unless specified otherwise. When examination and testing indicates defects in a weld joint, a qualified welder shall repair the weld in accordance with the paragraph entitled "Corrections and Repairs" of this

section.

3.4.1 Random NDE Testing

When liquid penetrant, magnetic particle, or ultrasonic examination is required, test a minimum of 10 percent of the total length or number of piping welds. Randomly select the welds examined, but include an examination of welds made by each welding operator or welder. If random testing reveals that a weld fails to meet minimum quality requirements, examine an additional 10 percent of the welds in that same group. If the additional welds examined meet the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds examined also fail to meet the quality requirements, that entire group of welds shall be rejected. Remove and reweld rejected welds or examine rejected welds 100 percent and remove and reweld defects.

3.4.2 Visual Examination

Visually examine welds as follows:

a. Before welding -- for compliance with requirements for joint preparation, placement of backing rings or consumable inserts, alinement and fit-up, and cleanliness.

b. During welding -- for conformance to the qualified welding procedure.

c. After welding -- for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.

3.4.3 Nondestructive Examination

NDE shall be in accordance with written procedures. Procedures shall conform to ASME BPVC SEC V. The approved procedure shall be demonstrated to the satisfaction of the Contracting Officer's QA personnel. In addition to the information required in ASME BPVC SEC V, the written procedures shall include:

a. Timing of the nondestructive examination in relation to the welding operations.

b. Safety precautions.

3.4.4 Examinations and Tests by the Government

Examinations and tests will conform to paragraphs "Visual Examination" and "Nondestructive Examination" of this section, except that destructive tests may be required also. When destructive tests are made, qualified welders or welding operators shall make repairs using welding procedures which will develop the full strength of the members cut. Welding shall be subject to examination and tests in the mill, shop, and field.

3.4.5 Not Used

3.5 ACCEPTANCE STANDARDS

3.5.1 Visual

The following indications are unacceptable:

a. Cracks--external surface.

b. Undercut on surface which is greater than 1.00 mm deep or 25 percent for ASME B31.3 and 12.5 percent for ASME B31.4 and ASME B31.9 of the wall thickness, whichever is less, provided that the remaining wall thickness is not less than the minimum design thickness.

c. Weld reinforcement:

(1) ASME B31.1, conform to Table I.

TABLE I
REINFORCEMENT OF GIRTH AND LONGITUDINAL BUTT WELDS

Thickness of Base Metal, millimeters (mm)	Maximum Thickness of Reinforcement for Design Temperature		
	Greater than 400oC	175oC-400oC	Less Than 175oC
	mm	mm	mm
Up to 3.00, incl.	2.00	2.50	5.00
Over 3.00 to 5.00, incl.	2.00	3.00	5.00
Over 5.00 to 13.00, incl.	2.00	4.00	5.00
Over 13.00 to 25.00, incl.	2.50	5.00	5.00
Over 25.00 to 50.00, incl.	3.00	6.00	6.00
Over 50.00	4.00	The greater of 6 mm or 1/8 times the width of the weld in mm.	

NOTES:
1. For double welded butt joints, this limitation on reinforcement given above shall apply separately to both inside and outside surfaces of the joint.
2. For single welded butt joints, the reinforcement limits given above shall apply to the outside surface of the joint only.
3. The thickness of weld reinforcement shall be based on the thickness of the thinner of the materials being joined.
4. The weld reinforcement thicknesses shall be determined from the higher of the abutting surfaces involved.
5. Weld reinforcement may be removed if so desired.

(2) ASME B31.3, conform to Table II.

TABLE II

Wall Thickness, mm	Height, mm
Less than or equal to 6.40	Less than or equal to 1.60
Greater than 6.40, is less than or equal to 12.70	Less than or equal to 3.20
Greater than 12.70, is less than or equal to 25.40	Less than or equal to 4.00
Greater than 25.40	Less than or equal to 4.80

NOTES:
1. Wall thickness is the nominal wall thickness of the thinner of components joined by butt weld.
2. Height: For "Normal Service" and "Severe Cyclic" conditions, use thelisted value. For "Category D Fluid Service," use twice the listed value. Measure from surfaces of adjacent components. The lesser of the two measurements, in any plane through the weld, shall not exceed the applicable value at right. Weld metal shall merge smoothly into component surfaces.

(3) ASME B31.4, conform to Table I for under 175 degrees C.

(4) ASME B31.5, conform to Table III.

TABLE III

Pipe Wall Thickness, mm	Reinforcement Thickness, mm
6.40 and under	1.60
Over 6.40 through 12.70	2.40
Over 12.70, through 25.40	3.20
Over 25.40	4.80

(5) ASME B31.9: Thickness of weld reinforcement shall not exceed 4.80 mm.

d. Lack of fusion on surface.

e. Incomplete penetration (applies only when inside surface is readily accessible).

f. Convexity of fillet weld surface greater than 10 percent of longest leg plus 1.0 mm.

g. Concavity in groove welds.

h. Concavity in fillet welds greater than 2.0 mm.

i. Fillet weld size less than indicated or greater than 1 1/4 times the minimum specified fillet leg length.

3.5.2 Magnetic Particle Examination

The following relevant indications are unacceptable:

a. Any cracks and linear indications.

b. Rounded indications with dimensions greater than 5.0 mm.

c. Four or more rounded indications in a line separated by 2.0 mm or less edge-to-edge.

d. Ten or more rounded indications in any 3870 sq. mm of surface, with the major dimension of this area not to exceed 150 mm, with the area taken in the most unfavorable location relative to the indications being evaluated.

3.5.3 Liquid Penetrant Examination

Indications whose major dimensions are greater than 2.0 mm shall be considered relevant. The following relevant indications are unacceptable:

a. Any cracks or linear indications.

b. Rounded indications with dimensions greater than 5.0 mm.

c. Four or more rounded indications in a line separated by 2.0 mm or less edge-to-edge.

d. Ten or more rounded indications in any 3870 sq. mm of surface, with the major dimension of this area not to exceed 150 mm, with the area taken in the most unfavorable location relative to the indications being evaluated.

3.5.4 Not Used

3.5.5 Ultrasonic Examination

Permitted for ASME B31.3 and ASME B31.4 piping only. Linear type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths which exceed the following:

a. 6.0 mm for t up to 19.0 mm

b. 1/3 t for t from 19.0 mm to 57.0 mm

c. 19.0 mm for t over 57.0 mm

("t" is the thickness of the weld being examined. If the weld joins two members having different thickness at the weld, "t" is the thinner of these two thicknesses. Discontinuities are interpreted to be cracks, lack of

fusion, and incomplete penetration are unacceptable regardless of length.)

3.6 CORRECTIONS AND REPAIRS

Remove defects and replace welds as specified in ANSI Piping Standards, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, reexamine the area by the same test methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. For repairs to base material, the minimum examination shall be the same as required for butt welds. Indication of a defect shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no unacceptable indications are present. The use of foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

TABLE IV
EXAMINATIONS AND TESTS FOR VARIOUS MATERIALS AND SERVICES

Examinations or Tests Required

Material or Application	Visual	Radiographic	Magnetic Particle or Liquid Penetrant	Ultra-sonic
High-alloy austenitic or nickel steels or nickel alloys for other than cryogenic or vacuum service				
a. Tack welds	Yes	No	No	No
b. Root passes	Yes	No	No	No
c. Intermediate passes	Yes	No	No	No
d. Completed weld	Yes	No	Yes(PT only)	Yes
Stainless steel to carbon steel				
a. Completed weld	Yes	No	Yes(PT only)	No
Carbon steel piping systems				
a. Tack welds	Yes	No	No	No
b. Root passes	Yes	No	No	No
c. Intermediate passes	Yes	No	No	No
d. Completed weld	Yes	No	No	No

TABLE IV
EXAMINATIONS AND TESTS FOR VARIOUS MATERIALS AND SERVICES

Examinations or Tests Required

Material or Application	Visual	Radiographic	Magnetic Particle or Liquid Penetrant	Ultra-sonic

SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010	(1994) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers
ARI 700	(1999) Specifications for Fluorocarbon Refrigerants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A117.1	(1998) ICC/ANSI A117.1 (Guidelines for Access Usable Buildings and Facilities)
ANSI Z21.22	(1999; A 2001) Relief Valves for Hot Water Supply Systems
ANSI Z124.5	(1997) Plastic Toilet (Water Closet) Seats

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 515/A 515M	(2003) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2003) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 733	(2003) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 74	(2003b) Cast Iron Soil Pipe and Fittings
ASTM A 888	(1998el) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 306	(2002) Copper Drainage Tube (DWV)
ASTM B 32	(2003) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 813	(2000e1) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 828	(2002) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1004	(2003) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1248	(2002) Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2661	(2002) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings

ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 2846/D 2846M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4551	(1996; R 2001) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D 638	(2003) Tensile Properties of Plastics
ASTM E 1	(2001) ASTM Thermometers
ASTM E 96	(2000e1) Water Vapor Transmission of Materials
ASTM F 409	(2002) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1999) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2002e1) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2002) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(1999e1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(2001; Errata 2002) Designation and Safety Classification of Refrigerants
ASHRAE 90.1	(2001; various Errata) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2002) Atmospheric Type Vacuum Breakers
ASSE 1003	(2001) Water Pressure Reducing Valves
ASSE 1005	(1999) Water Heater Drain Valves
ASSE 1010	(1996) Water Hammer Arresters
ASSE 1011	(1993) Hose Connection Vacuum Breakers
ASSE 1012	(2002) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1999) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
ASSE 1018	(2001) Trap Seal Primer Valves, Water Supply Fed
ASSE 1020	(1998) Pressure Vacuum Breaker Assembly
ASSE 1037	(1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C606	(1997) Grooved and Shouldered Joints

AWWA C651	(1999) Disinfecting Water Mains
AWWA C652	(2002) Disinfection of Water-Storage Facilities
AWWA C700	(2002) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(2002) Cold-Water Meters - Turbine Type, for Customer Service
AWWA C707	(2005) Encoder-Type Remote Registration Systems for Cold-Water Meters
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2	(1991; R 2002) Air Gaps in Plumbing Systems
ASME A112.14.1	(1975; R 1998)Backwater Valves
ASME A112.18.1	(2000) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.19.3	(2001) Stainless Steel Fixtures (Designed for Residential Use)
ASME A112.21.2M	(1983) Roof Drains
ASME A112.36.2M	(1991; R 2002) Cleanouts
ASME A112.6.1M	(1997; R 2002) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2000) Floor and Trench Drains
ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch

ASME B16.12	(1998) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2002) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500
ASME B16.29	(2002) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(1999) Malleable Iron Threaded Fittings
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2000) Pressure Gauges and Gauge Attachments

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR Manual	(9th Edition) Manual of Cross-Connection Control

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1	(2003) Accessible and Usable Buildings and Facilities
ICC IPC	(2003)International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2002) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002) Butterfly Valves
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2001) Class 3000 Steel Pipe Unions Socket-Welding and Threaded

MSS SP-85	(2002) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14	(2003) Plastics Piping Components and Related Materials
NSF 61	(2002e) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1998) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(1997) Hose Clamp Specifications

UNDERWRITERS LABORATORIES (UL)

UL 174	(1996; Rev thru Oct 1999) Household Electric Storage Tank Water Heaters

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523	(1974; A 1999) Safe Drinking Water Act

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430	Energy Conservation Program for Consumer Products
40 CFR 50.12	National Primary and Secondary Ambient Air Quality Standards for Lead

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Work; G

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

Hot Water Heater and Circulation System Details; G

Detail drawings for the hot water heater and circulation system including physical dimensions of each component, location and sizes of all connections shall be developed. Detailed drawings for the hot water system shall demonstrate coordination between all supply and return connections, pipe sizes, and supporting equipment/appurtenances. Detail drawings shall be drawn to scale.

SD-03 Product Data

Plumbing Fixture Schedule

Catalog cuts of specified plumbing fixtures, valves, related piping system and system location where installed.

Vibration-Absorbing Features; G

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and

spigot and hubless joints for cast iron soil pipe.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies; G.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests. The original, signed Form 15400-BPA-Form and an electronic copy of the completed form shall be provided.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Plumbing System; G.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown, at least 2 weeks prior to field training. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. Manuals shall feature all relevant engineering units in both English and Metric units. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

1.5 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC.

1.6 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Material or equipment containing lead shall not

be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8. End point devices such as electric water coolers, lavatory faucets, kitchen faucets, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums.

2.1.1 Pipe Joint Materials

Hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Deleted.

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.

g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

h. Solder Material: Solder metal shall conform to ASTM B 32.

i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.

l. Deleted.

m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.

n. Deleted.

o. Deleted.

p. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

q. Deleted.

r. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

s. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

t. Deleted.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201.

b. Copper, Sheet and Strip for Building Construction: ASTM B 370.

c. Asphalt Roof Cement: ASTM D 2822.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Deleted.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22

Description Standard

2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm male inlet threads, hexagon shoulder, and 20 mm hose connection. Faucet handle shall be securely attached to stem.

2.3.2 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 20 mm exposed hose thread on spout and 20 mm male pipe thread on inlet.

2.3.3 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 59 kW shall have 20 mm minimum inlets, and 20 mm outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW shall have 25 mm minimum inlets, and 25 mm outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.4 Thermostatic Mixing Valves

Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 2 degrees C of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degrees C water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Enameled cast-iron lavatories shall be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets shall be porcelain enameled. Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze,

nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Strainers for floor and shower drains shall be square, unless noted otherwise.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain to waste piping. Polyethylene for floor drains shall conform to ASTM D 1248. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.2 Funnel Drains

Funnel drains shall consist of body, integral seepage pan, and adjustable strainer with perforated or slotted grate and funnel extension. The strainer shall have a threaded collar to permit adjustment to floor thickness. Drains shall be of double drainage pattern suitable for embedding in the floor construction. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided for other than concrete construction. Drains shall have a galvanized heavy cast-iron body and seepage pan and chromium-plated bronze, nickel-bronze, or nickel-brass strainer and funnel combination. Drains shall be provided with threaded connection and with a separate cast-iron "P" trap, unless otherwise indicated. Drains shall be circular, unless otherwise indicated. The funnel shall be securely mounted over an opening in the center of the strainer. Minimum dimensions shall be as follows:

Area of strainer and collar	0.023 square meters
Height of funnel	95 mm
Diameter of lower portion of funnel	50 mm
Diameter of upper portion of funnel	100 mm

2.6.3 Roof Drains and Expansion Joints

Roof drains shall conform to ASME A112.21.2M, with dome and integral

flange, and shall have a device for making a watertight connection between roofing and flashing. The whole assembly shall be galvanized heavy pattern cast iron. For aggregate surface roofing, the drain shall be provided with a gravel stop. On roofs other than concrete construction, roof drains shall be complete with underdeck clamp, sump receiver, and an extension for the insulation thickness where applicable. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided when required to suit the building construction. Strainer openings shall have a combined area equal to twice that of the drain outlet. The outlet shall be equipped to make a proper connection to threaded pipe of the same size as the downspout. An expansion joint of proper size to receive the conductor pipe shall be provided. The expansion joint shall consist of a heavy cast-iron housing, brass or bronze sleeve, brass or bronze fastening bolts and nuts, and gaskets or packing. The sleeve shall have a nominal thickness of not less than 3.416 mm Gaskets and packing shall be close-cell neoprene, O-ring packing shall be close-cell neoprene of 70 durometer. Packing shall be held in place by a packing gland secured with bolts.

2.7 SHOWER PAN

Shower pan may be copper, or nonmetallic material.

2.7.1 Sheet Copper

Sheet copper shall be 4.9 kg per square meter weight.

2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 1.016 mm minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with ASTM D 4551.

2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 1.016 mm (0.040 inch) minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. ASTM D 638:

Ultimate Tensile Strength:	1.79 MPa
Ultimate Elongation:	398 percent
100 Percent Modulus:	3.07 MPa

b. ASTM D 1004:

Tear Strength:	53 kilonewtons per meter

c. ASTM E 96:

Permeance:	0.46 ng per Pa per second per square meter

d. Other Properties:

Specific Gravity:	1.29
PVC Solvent:	Weldable
Cold Crack:	minus 47 degrees C
Dimensional stability, 100 degrees C	
Hardness, Shore A:	89

2.8 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.813 mm thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm The interior diameter shall be not more than 3.2 mm over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.9 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 32 to 71 degrees C Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified.

2.9.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.9.1.1 Not Used

2.9.1.2 Electric Type

Electric type water heaters shall conform to UL 174 with dual heating elements. Each element shall be 6 KW. A phenolic resin coating shall be provided.

2.9.2 Instantaneous Water Heater

Heater shall feature a solid copper heat exchanger. Unit shall be certified for 1.03 MPa working pressure. Heating elements shall be copper sheathed. Unit shall feature a power on indicator light and thermal cut-out; enclosure shall be designed for installation inside cabinetry, or beneath a lavatory.

2.10 PUMPS

2.10.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Pump volute seal ring shall be replaceable. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 4 enclosure. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall be stainless and shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the capacity of the first pump. Pressure gauges shall be mounted on the discharge headers. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump. Pumps shall be mounted on a manufacturer provided slide rail for ease of installation and removal.

2.10.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than 746 W shall have integral thermal overload protection in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Pumps shall feature a replaceable cartridge for ease of service. Guards shall shield exposed moving parts.

2.10.3 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each

pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.11 NON-POTABLE GRAY WATER PRESSURE SYSTEM

2.11.1 Constant Speed Pumping System

The pumps shall be protected from thermal buildup, when running at no-flow, by a common thermal relief valve. A control panel shall be mounted in the Mechanical Room in a NEMA 250, Type 1 enclosure. The control panel shall include the following: 7-day 24 hour per day time clock for user adjustable, scheduled, down-time; audiovisual alarm with separate audio and visual resets; transformer; current relays; "HAND-OFF-AUTOMATIC" switches for each pump; separate run time counters; and indicating lights for power on, individual motor overload, and fault. The control circuit shall be interlocked such that failure of either pump will initiate an alarm, and also energize the succeeding pump.

2.11.2 Hydro-Pneumatic Water Pressure System

The tank shall be an ASME code constructed vessel stamped for 862 kPa water working pressure. The tank shall have a flexible diaphragm and shall be factory precharged to 207 kPa.

2.12 DOMESTIC WATER SERVICE METER

Cold water meters 50 mm and smaller shall be positive displacement type conforming to AWWA C700. Meter shall feature an encoder type remote register designed in accordance with AWWA C707. Cold water meters 64 mm and larger shall be turbine type, bronnz, Class II, conforming to AWWA C701 Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A gate valve or full port ball valve and drain shall be installed on the water service line inside the building approximately 150 mm above the floor from point of entry. Isolation valves 50 mm and smaller shall be full port ball type. Provide suitable isolation valves at each plumbing fixture group (of two or more fixtures); water heater; pump; and tank. Provide adequate isolation valves to isolate the entire hot water recirculation system. Piping shall be connected to the exterior service lines or capped or

plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 12 mm between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made

with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm hose bibb with renewable seat and full port ball valve ahead of hose bibb. At other low points, 20 mm brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 100 mm in diameter or larger shall be provided with thrust blocks to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with

precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels, whether indicated or not. Commercial-type water hammer arresters shall conform to ASSE 1010. Provide isolation valves at each water hammer arrester for maintenance. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm and smaller; flanges shall be used on pipe sizes 80 mm and larger.

3.1.2.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.4 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 50 mm and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

3.1.2.5 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.6 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.4.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel

pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 12 mm from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete or masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840 FIRESTOPPING.

3.1.4.2 Flashing Requirements

Pipes passing through roof shall be installed through a 4.9 kg per square meter copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.4.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mm from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and

drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 40 mm to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.4.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 150 mm in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.4.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 6 to 13 mm wide by 6 to 10 mm deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07920 JOINT SEALANTS.

3.1.5 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.1.6 Supports

3.1.6.1 General

Hangers used to support piping 50 mm and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.6.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.6.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 100 mm and larger when the temperature of the medium is 15 degrees C or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 100 mm

(2) Be used on insulated pipe 100 mm and larger when the temperature of the medium is 15 degrees C or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. Operating temperatures in determining hanger spacing for CPVC pipe shall be 82 degrees C. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m nor more than 2 m from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 100 mm and larger when the temperature of the medium is 15 degrees C or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 100 mm a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 100 mm and larger carrying medium less that 15 degrees C a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.6.4 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.7 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the

floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mm of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm above the top of the tank or water heater.

3.2.2 Installation of Water Heater

Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 600 mm just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 600 mm before turning in an

upward direction.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed at heights shown on architectural drawings or as required. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure. Bumpers for water closet seats shall be installed on the flushometer stop.

3.3.3 Height of Fixture Rims Above Floor

Fixtures shall be mounted at heights shown on architectural drawings.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the

floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.4.3 Support for Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.4 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced,

maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.7 Funnel Drains

Funnel drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.9 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.9.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 150 mm for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.9.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flatlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 liter per square meter A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.3.9.3 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat

lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 12 mm from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 12 mm from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 4 degrees C the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 0.73 kg per square meter dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.9.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 150 mm in room areas and 75 mm above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 25 mm of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 50 mm Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 600 or 900 mm at a time shall be welded. On wood subflooring, two layers of 0.73 kg per square meter (15 pound) felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Pumps supported by piping shall be provided with suitable vibration isolating connectors. Isolation unit installation shall limit vibration to 20 to 40 percent of the lowest equipment rpm.

3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

3.6 IDENTIFICATION SYSTEMS

3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m width, 750 mm height, and 12 mm thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm transparent plastic cover. Unless otherwise directed, the color code

symbols shall be approximately 20 mm in diameter and the related lettering in 12 mm high capital letters. The color code board shall be mounted and located in the mechanical or equipment room.

3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

3.9 TESTS, FLUSHING AND DISINFECTION

3.9.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.9.1.1 Test of Backflow Prevention Assemblies

Backflow Prevention Assemblies (BPA’s) shall be tested by a Washington State certified tester. The tester shall complete the attached form (15400-BPA-Form) and shall submit the original signed form, plus a copy of the completed form in electronic format.

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 25 mm for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for

rejection, repair, and retest.

3.9.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.9.3 System Flushing

3.9.3.1 During Flushing

Before operational tests or disinfection, potable and nonpotable water piping systems shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and electric water coolers, to include any device considered as an end point device by NSF 61, Section 9, shall be flushed a minimum of 1 L per 24 hour period, ten times over a 14 day period.

3.9.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 50.12 Part 141.80(c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.9.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each

system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Operation of the gray water pressure system, including pump start pressure and stop pressure.

3.9.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance

with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 24 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operation and Maintenance manual for Plumbing Systems.

3.11 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, wall mounted.

Seat - ANSI Z124.5, Type A, white plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 66.7 mm at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 6 liters per flush.

P-1A WATER CLOSET HANDICAPPED:

Height of top rim of bowl shall be as shown on architectural drawings for handicapped water closet. Other features shall be the same as P-1.

P-1B WATER CLOSET (WATER SAVER):

Water closet shall be "High Efficiency Type" (HET) or dual flush type.

HET type shall feature a maximum water usage of 5 liters per flush. HET type may be floor mounted. Other features shall be the same as P-1.

Dual flush type shall feature dual 6/3 liters maximum per flush modes. Dual flush fixture style may be wash down type; bowl may be regular or elongated; floor mounted or wall hung. Dual flush wall hung style shall feature a concealed tank suitable for inwall applications. Other features shall be the same as P-1.

P-2 URINAL:

Urinal shall be vitreous china and shall be in accordance with ASME A112.19.2M and ANSI A117.1. Fixture shall be a waterless/waterfree,

non-flushing type, with replaceable trap insert or cartridge. The replaceable trap insert shall contain a low specific gravity immiscible barrier liquid. The liquid shall be biodegradable. The urinal and trap assembly shall maintain a sufficient barrier of immiscible liquid necessary to inhibit backflow of sewer gases. Four sets of replacement trap inserts or cartridges shall be provided with each urinal.

P-3 LAVATORY:

Manufacturer's standard sink depth, vitreous china ASME A112.19.2M, wall mount.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be single control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.095 liters per second at a flowing pressure of 549 kPa

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel. See paragraph FIXTURES for optional plastic accessories.

P-3A WHEELCHAIR LAVATORY:

Vitreous china, ASME A112.19.2M, wheelchair lavatory with wrist or elbow controls 508.0 mm wide x 685.8 mm deep with gooseneck spout. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing water pressure of 549 kPa

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel.

P-3B COUNTERTOP LAVATORY

Manufacturer's standard sink depth, vitreous china ASME A112.19.2M, countertop, oval.

Faucet -
Light powered, sensor activated, with self adapting sensor, battery back-up, magnetic solenoid valve, and integral mixing valve. Laminar flow spray head for 0.139 liters per second flow.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel.

P-4 KITCHEN SINK:

Ledge back with holes for faucet and spout double bowl, 812.8 x 533.4 mm stainless steel ASME A112.19.3.

Faucet and Spout - Faucets shall meet the requirements of NSF 61, Section 9. Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 0.126 liters per second at a flowing water pressure of 414 kPa

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

P-5 SERVICE SINK:

Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3 corner, floor mounted 711.2 mm square, 171.5 mm deep.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads. With rubber hose and wall hook.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

Trap - Cast iron, minimum 7.5 cm diameter.

P-6 SHOWER:

Shower heads, ASME A112.18.1, shall be adjustable spray type and shall include a non-removable, tamperproof device to limit water flow to 0.11 liters per second when tested in accordance with ASME A112.18.1.

Wall Mounted: Shower head shall be stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be pressure balancing mixing, single lever type with integral stops. Shower head shall be vandalproof with integral back.

Accessible-type shall include a shower spray unit with a hose at least 1525 mm (60 inches) long that can be used as a fixed shower head or as a hand-held shower.

P-7 ELECTRIC WATER COOLERS:

Electric water coolers shall meet the requirements of NSF 61, Section 9,

shall be self contained, conform to ARI 1010, and use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05. Shall deliver not less than 30.2 L/hour of water at 10 degrees C with an inlet water temperature of 27 degrees C and ambient air temperature of 32 degrees C. Electric water coolers shall have a self-closing valve with automatic stream regulator, flow control capability, an in-line inlet strainer, and have push-button or bar actuation. Exposed surfaces of stainless steel shall have a satin finish. Waste strainers shall be made of chrome plated brass or stainless steel.

P-7 ELECTRIC WATER COOLERS (BI-LEVEL TYPE):

Electric water coolers shall be accessible, split level-type with round bowls and meet the requirements of NSF 61, Section 9, shall be self contained, conform to ARI 1010, and use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05. Shall deliver not less than 30.2 L/hour of water at 10 degrees C with an inlet water temperature of 27 degrees C and ambient air temperature of 32 degrees C. Electric water coolers shall have a self-closing valve with automatic stream regulator, flow control capability, an in-line inlet strainer, and have push-button or bar actuation. Exposed surfaces of stainless steel shall have a satin finish. Waste strainers shall be made of chrome plated brass or stainless steel.

Units shall have bowls made of stainless steel. The unit shall have concealed fasteners and be for interior installation. Chiller portion shall be recessed in the wall and back panel shall be installed flush with the adjacent wall surface.

P-8 FOOT WASH

Shower heads, ASME A112.18.1, shall be ADA compliant, max faucet length of 170mm; circular faucet base less than 50mm diameter. Style shall be similar to Domaine by Porcher; Purist by Kohler; Stemma by Porcher; or equal.

Wall Mounted: Shower head shall be stainless steel or chrome plated brass or zinc. Head shall consist of a hand held three-way shower nozzle and suitable wall mount holder with minimum 1.8 meter (72 inch) long metal shower hose. Handles shall be chrome-plated brass or die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be pressure balancing mixing, single lever type with integral stops.

Foot Wash Drain: Precast polymer with vertical preformed knock-out for 4" discharge, light duty with 1/4" slotted polypropylene or stainless grate.

P-9 BAPTISTRY

For Baptistry see SECTION 11040, PREFABRICATED BAPTISTERY

3.12 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.13 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 21 degrees C delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/0.093 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 38 degrees C delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

3.13.1 Storage Water Heaters

3.13.1.1 Electric

a. Storage capacity of 454 liters or less, and input rating of 12 kW or less: minimum energy factor (EF) shall be 0.95-0.00132V per 10 CFR 430.

b. Storage capacity of more than 454 liters or input rating more than 12 kW: maximum SL shall be 1.9 w/0.093 sq. m. per ASHRAE 90.1, Addenda B.

3.13.2 Unfired Hot Water Storage

Volumes and inputs: maximum HL shall be 20.5 W/sq. meter.

3.14 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE				
Item #	Pipe and Fitting Materials	A	B	C	D	E
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X
5 thru 8 - Deleted.						
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X
11	Seamless red brass pipe, ASTM B 43		X	X		
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X
14	Seamless copper pipe, ASTM B 42				X	
15	Cast bronze threaded fittings, ASME B16.15				X	X

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE				
Item #	Pipe and Fitting Materials	A	B	C	D	E
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
* - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
1 thru 5 - Deleted.					
6	Bronze flanged fittings, ASME B16.24 for use with Item 7	X	X		X
7	Seamless copper pipe, ASTM B 42	X	X		X
8	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**		X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Item 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 7 and 8	X	X		X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X		X
12 thru 18 - Deleted.					
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D 2846/D 2846M			X	
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M			X	
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M			X	
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 20, and 21			X	

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22			X	
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22			X	
25 thru 32 - Deleted.					
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X		
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A 733	X	X		

A - Cold Water Service Aboveground
B - Hot and Cold Water Distribution 82 degree C Maximum Aboveground
C - Non-Potable Water System
D - Hot and Cold Water Service Belowground
Indicated types are minimum wall thicknesses.
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Elect.	454 max.	12 kW max.	10 CFR 430	EF = 0.95-0.00132V minimum
Elect.	454 min. OR	12 kW min.	ASHRAE 90.1 (Addenda B)	SL = 1.9 W/0.09 sq. m. maximum

B. Unfired Hot Water Storage.

Volumes and inputs: maximum HL shall be 20.5 W/sq. meter

TERMS:

EF = Energy factor, overall efficiency.
ET = Thermal efficiency with 21 degrees C delta T.
EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).
SL = Standby loss in W/0.09 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 32 degrees C delta T.
HL = Heat loss of tank surface area
V = Storage volume in gallons

-- End of Section --

SECTION 15556

FORCED HOT WATER HEATING SYSTEMS USING WATER TO WATER HEAT EXCHANGERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C606	(1997) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1999) Malleable Iron Threaded Fittings
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End

ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2001) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 183	(2003) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234/A 234M	(2002) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 366/A 366M	(1997e1) Commercial Steel, Sheet, Carbon,(0.15 Maximum Percent Cold-Rolled**
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 515/A 515M	(2003) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2003) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings

ASTM A 569/A 569M	(1998) Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 733	(2003) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(2003) Solder Metal
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 650	(1995; R 2002) Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
ASTM B 687	(1999) Brass, Copper, and Chromium-Plated Pipe Nipples
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 813	(2000e1) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 828	(2002) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 1248	(2002) Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D 2000	(2003) Rubber Products in Automotive Applications
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 596	(2001) Reporting Results of Analysis of Water

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA Stds	(2003) EJMA Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2002) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2002) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

PLUMBING-HEATING-COOLING CONTRACTORS NATIONAL ASSOCIATION (PHCC)

NAPHCC NSPC	(2003) National Standard Plumbing Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating System

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Spare Parts

Spare parts data for each different item of material and equipment specified , after approval of the related submittals and not later than 3 months prior to the date of beneficial occupancy.

The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Welding

Three copies of qualified procedures and list of names and identification symbols of qualified welders and welding operators, prior to welding operations.

Framed Instructions

Proposed diagrams, instructions, and other sheets, prior to posting. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system.

SD-06 Test Reports

Testing and Cleaning

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

Water Treatment Testing

The water quality test report shall identify the chemical composition of the heating water. The report shall include a comparison of the condition of the water with the chemical company's recommended conditions. Any required corrective action shall be documented within the report.

SD-07 Certificates

Bolts

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Heating System

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Operating

manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, water treatment procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall feature all relevant engineering units in both English and Metric units. Manuals shall be provided prior to the field training course.

1.3 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature

equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.1.4 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

2.1.5 Electrical Work

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment (including motor efficiencies), and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring, conduit, and connection to power required for controls and devices but not shown shall be provided.

2.2 PIPING, TUBING, AND FITTINGS

2.2.1 General

Piping, tubing, and fittings shall be as follows:

a. Water piping shall be black steel or copper tubing with cast iron, malleable iron or steel, solder-joint, flared-tube or grooved mechanical joint fittings.

b. Vent piping shall be black steel, Schedule 40, with black malleable iron fittings.

2.2.2 Steel Pipe

Pipe shall conform to ASTM A 53/A 53M or ASTM A 106, Grade A or B, black steel, Schedule 40, unless otherwise specified. Steel pipe to be bent shall be ASTM A 53/A 53M, Grade A, standard, or Grade B, extra strong weight.

2.2.3 Gauge Piping

Piping shall be copper tubing for water.

2.2.4 Malleable Iron Pipe Fittings

Fittings shall conform to ASME B16.3, type required to match adjacent piping.

2.2.5 Cast Iron Pipe Fittings

Fittings shall conform to ASME B16.1 or ASME B16.4 type required to match adjacent piping.

2.2.6 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.2.6.1 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M with WPA marking. Butt welded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

2.2.6.2 Grooved Mechanical Fittings

Standard fittings shall be of malleable iron conforming to ASTM A 47/A 47M, Grade 32510, or ductile iron conforming to ASTM A 536, Grade 65-45-12. Fittings may also be constructed of steel, conforming to ASTM A 106, Grade B or ASTM A 53/A 53M.

2.2.6.3 Grooved Mechanical Pipe Joints

Pipe joints shall conform to AWWA C606. Grooved mechanical joint fittings shall be full flow factory manufactured forged steel fittings. Fittings, couplings, gaskets, and pipe grooving tool or grooved end pipe shall be products of the same manufacturer. Mechanical pipe couplings shall be of the bolted type and shall consist of a housing fabricated in two or more parts, a synthetic rubber gasket, and nuts and bolts to secure unit together. Housings shall be of malleable iron conforming to ASTM A 47/A 47M, Grade 32510 or ductile iron conforming to ASTM A 536, Grade 65-45-12. Coupling nuts and bolts shall be of steel and conform to ASTM A 183. Gaskets shall be of molded synthetic rubber, Type EPDM or Buna-N with central cavity, pressure responsive configuration and shall conform to ASTM D 2000.

2.2.7 Copper Tubing and Fittings

2.2.7 Copper Tubing

Tubing shall be ASTM B 88, ASTM B 88M, Type K or L.

2.2.8 Solder-Joint Pressure Fittings

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75M. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and ASTM B 828.

2.2.9 Flared Fittings

Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62.

2.2.10 Adapters

Adapters for copper tubing shall be brass or bronze for brazed fittings. Adapters may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

2.2.11 Threaded Fittings

Cast bronze threaded fittings shall conform to ASME B16.15.

2.2.12 Brazing Material

Brazing material shall conform to AWS A5.8.

2.2.13 Brazing Flux

Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides, and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

2.2.14 Solder Material

Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

2.2.15 Solder Flux

Flux shall be either liquid or paste form, non-corrosive and conform to ASTM B 813.

2.2.7.10 Grooved Mechanical Fittings

Joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be ductile iron conforming to ASTM A 536. Gaskets shall be molded synthetic rubber with central cavity, pressure responsible configuration and shall conform to ASTM D 2000, for circulating medium up to 110 degrees C. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts shall be steel and shall conform to ASTM A 183.

2.2.16 Joints and Fittings for Copper Tubing

Wrought copper and bronze fittings shall conform to ASME B16.22 and ASTM B 75M . Cast copper alloy fittings shall conform to ASME B16.18 and ASTM B 828. Flared fittings shall conform to ASME B16.26 and ASTM B 62. Adaptors may be used for connecting tubing to flanges and threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Cast bronze threaded fittings shall conform to ASME B16.15. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536.

Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C . Grooved joints shall conform to AWWA C606. Coupling nuts and and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.2.17 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns., etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.2.18 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.2.19 Nipples

Nipples shall conform to ASTM A 733 or ASTM B 687, standard weight.

2.2.20 Unions

Unions shall conform to ASME B16.39, type to match adjacent piping.

2.2.21 Adapters

Adapters for copper tubing shall be brass or bronze for soldered fittings.

2.2.22 Dielectric Waterways

Dielectric waterways shall conform to the tensile strength and dimensional requirements specified in ASME B16.39. Waterways shall have metal connections on both ends to match adjacent piping. Metal parts of dielectric waterways shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.2.23 Grooved Mechanical Joints

Rigid grooved pipe joints may be provided in lieu of unions, welded, flanges or screwed piping connections at chilled water pumps and allied equipment, and on aboveground pipelines in serviceable locations, if the temperature of the circulating medium does not exceed 110 degrees C (230 degrees F). Flexible grooved joints will not be permitted, except as

vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to insure positive rigid clamping of the pipe. Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications, will not be permitted. Rigid grooved pipe couplings shall be used with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 862 kPa (125 psi) service and appropriate for static head plus the pumping head, and shall provide a water-tight joint. Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations. The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and verify the groove dimensions in accordance with the coupling manufacturer's specifications.

2.2.24 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 1.034 MPa (150 psi) or 1.034 MPa (150 psi) service as appropriate for the static head plus the system head, and 121 degrees C (250 degrees F). Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, temperature, and circulating medium. The flexible section may have threaded, welded, soldered, flanged, grooved, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.3 MATERIALS AND ACCESSORIES

2.3.1 Iron and Steel Sheets

2.3.1.1 Galvanized Iron and Steel

Galvanized iron and steel shall conform to ASTM A 653/A 653M, with general requirements conforming to ASTM A 653/A 653M. Gauge numbers specified are Manufacturer's Standard Gauge.

2.3.1.2 Uncoated (Black) Steel

Uncoated (black) steel shall conform to ASTM A 366/A 366M or ASTM A 569/A

569M, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to Manufacturer's Standard Gauge.

2.3.2 Solder

Solder shall conform to ASTM B 32. Solder and flux shall be lead free. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B 813.

2.3.3 Solder, Silver

Silver solder shall conform to AWS A5.8.

2.3.4 Thermometers

Mercury shall not be used in thermometers. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 225 mm (9 inch) scale, and thermometers shall have rigid stems with straight, angular, or inclined pattern.

2.3.5 Gauges

Gauges shall conform to ASME B40.1.

2.3.6 Gaskets for Flanges

Composition gaskets shall conform to ASME B16.21. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 6.6 mm (1/16 inch) thickness, full face or self-centering flat ring type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). NBR binder shall be used for hydrocarbon service. Gaskets shall be suitable for pressure and temperatures of piping system.

2.3.7 Polyethylene Tubing

Low-density virgin polyethylene shall conform to ASTM D 1248, Type I, Category 5, Class B or C.

2.3.8 Bellows-Type Joints

Joints shall be flexible, guided expansion joints. Expansion element shall be of stainless steel. Bellows-type expansion joints shall be in accordance with the applicable requirements of EJMA Stds and ASME B31.1 with internal liners.

2.3.9 Expansion Joints

Expansion joints shall provide for either single or double slip of connected pipes, as required or indicated, and for not less than the traverse indicated. Joints shall be designed for packing injection under full line pressure. End connections shall be flanged or beveled for welding as indicated. Joints shall be provided with anchor base where

required or indicated. Where adjoining pipe is carbon steel, the sliding slip shall be seamless steel plated with a minimum of 0 0508 mm (2 mils) of hard chrome conforming to ASTM B 650. Joint components shall be fabricated from material equivalent to that of the pipeline. Initial settings shall be made in accordance with manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by joint manufacturer, but in any case shall not be more than 1.5 m from expansion joint except for lines 100 mm (4 inches) or smaller, guides shall be installed not more than 600 mm (2 feet) from the joint. Service outlets shall be provided where indicated.

2.3.10 Flexible Ball Joints

Flexible ball joints shall be constructed of alloys as appropriate for the service intended. Where so indicated, the ball joint shall be designed for packing injection under full line pressure to contain leakage. Joint ends shall be threaded (to 50.8 mm (2 inches) only), grooved, flanged or beveled for welding as indicated or required and shall be capable of absorbing a minimum of 15-degree angular flex and 360-degree rotation. Balls and sockets shall be of equivalent material as the adjoining pipeline. Exterior spherical surface of carbon steel balls shall be plated with 0.0508 mm (2 mils) of hard chrome conforming to ASTM B 650. Ball type joints shall be designed and constructed in accordance with ASME B31.1 and ASME BPVC SEC VIII D1, where applicable. Flanges where required shall conform to ASME B16.5. Gaskets and compression seals shall be compatible with the service intended.

2.3.11 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 VALVES FOR LOW TEMPERATURE WATER HEATING SYSTEMS

2.4.1 Check Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 3 or 4, Class 125. Sizes 80 mm (3 inches) through 300 mm (24 inches), cast iron shall conform to MSS SP-71, Type III or IV, Class 125.

2.4.2 Globe Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 80 mm (3 inches) through 300 mm (12 inches), cast iron shall conform to MSS SP-85, Type III, Class 125.

2.4.3 Angle Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 125. Sizes 80 mm (3 inches) through 300 mm (12 inches), cast iron shall conform to MSS SP-85, Type III, Class 125.

2.4.4 Gate Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1 or 2, Class 125. Sizes 80 mm (3 inches) through 1200 mm (48 inches), cast iron shall conform to MSS SP-70, Type I, Class 125, Design OT or OF (OS&Y), bronze trim.

2.4.5 Air Vents

Air vents shall be provided at all piping high points in water systems, with block valve in inlet and internal check valve to allow air vent to be isolated for cleaning and inspection. Outlet connection shall be piped to nearest open site or suitable drain, or terminated 300 mm above finished grade. Pressure rating of air vent shall match pressure rating of piping system. Body and cover shall be cast iron or semi-steel with stainless steel or copper float and stainless steel or bronze internal parts. Air vents installed in piping in chase walls or other inaccessible places shall be provided with an access panel.

2.4.6 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register degree of valve opening. Valves shall be calibrated so that flow in liters per minute (gpm) can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 121 degrees C (250 degrees F) temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing. Plug valves and ball valves 200 mm (8 inches) or larger shall be provided with manual gear operators with position indicators.

2.4.7 Automatic Flow Control Valves

The valves shall be designed to be sensitive to pressure differential across the valve to provide the required opening. The valves shall be selected for the flow required and provided with a permanent nameplate or tag carrying a record of the factory-determined flow rate and flow control pressure levels. Valves shall control the flow within 5 percent of the tag rating. Valves shall be suitable for the maximum operating pressure of 862 kPa (125 psi) or 150 percent of the system operating pressure, whichever is greater. Valves shall be suitable for the maximum system operating temperature and pressure. Valve materials shall be same as specified for low temperature heating system check, globe, angle and gate valves. Valve operator shall be the electric motor type or pneumatic type as applicable. Valve operator shall be capable of positive shutoff against the system pump head.

2.4.8 Gravity Flow Control Valves

Ends shall be soldered, threaded, or flanged type as applicable, and designed for easy cleaning without disconnecting piping. Valves for copper tubing shall be bronze. Valves shall prevent flow due to gravity when circulators are off.

2.4.9 Radiator Valves

Automatic thermostatic radiator valves shall be self-contained controlled nonelectric temperature control valves. Valve bodies shall be constructed of chrome plated brass and shall be angle or straight pattern as indicated, with threaded or brazed end connections. Valve disc shall be of ethylene propylene or composition material. Thermostatic operators shall be a modulating type consisting of a sensing unit counter balanced by a spring setting.

2.5 VALVES FOR WATER SYSTEMS

2.5.1 Check Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Class 300 Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Class 300 minimum. Sizes 80 mm (3 inches) through 600 mm (24 inches), steel shall conform to ASME B16.34, Class 300 minimum, flanged ends, swing disc; water service to 454 degrees C (850 degrees F).

2.5.2 Globe Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 300 minimum. Sizes 80 mm (3 inches) through 600 mm (24 inches), steel shall conform to ASME B16.34, Class 300 minimum, flanged ends; water service to 454 degrees C (850 degrees F).

2.5.3 Angle Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1, 2 or 3, Class 300 minimum. Sizes 80 mm (3 inches) through 600 mm (24 inches), steel shall conform to ASME B16.34, Class 300 minimum, flanged ends; water service to 454 degrees C (850 degrees F).

2.5.4 Gate Valves

Sizes 65 mm (2-1/2 inches) and less, bronze shall conform to MSS SP-80, Type 1, or 2, Class 300 minimum. Sizes 80 mm (3 inches) through 600 mm (24 inches), steel shall conform to ASME B16.34, Class 300 minimum, flanged ends; water service to 454 degrees C (850 degrees F). Gate shall be split wedge (double disc) type.

2.6 COLD WATER CONNECTIONS

Connections shall be provided which include consecutively in line a strainer, backflow prevention device, and water pressure regulator. The backflow prevention device shall be provided as indicated and in compliance

with Section 15400 PLUMBING, GENERAL PURPOSE.

2.6.1 Strainers

Basket or Y-type strainers shall be the same size as the pipelines in which they are installed. Strainer bodies shall be rated for 862 kPa (125 psi) service, with bottoms drilled and plugged. Bodies shall have arrows cast on the sides to indicate the direction of flow. Each strainer shall be equipped with a removable cover and sediment basket. Basket shall not be less than 0.795 mm (22 gauge) and shall have perforations to provide a net free area through the basket of at least four times that of the entering pipe.

2.6.2 Pressure Regulating Valve

Valve shall be a type that will not stick nor allow pressure to build up on the low side. Valve shall be set to maintain a terminal pressure approximately 35 kPa (5 psi) in excess of the static head on the system and shall operate within a 138 kPa (20 psi) variation regardless of initial pressure and without objectionable noise under any condition of operation.

2.7 EXPANSION TANK

Pressurization system shall include a replaceable diaphragm-type captive air expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. Sizes shall be as indicated. Expansion tank shall be welded steel, constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 862 kPa (125 psig) and precharged to the minimum operating pressure. Tank air chamber shall be fitted with an air charging valve. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations.

2.8 AIR SEPARATOR TANK

External air separation tank shall be steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 862 kPa (125 psi). The capacity of the air separation tank indicated is minimum.

2.9 HEAT EXCHANGERS

Heat exchangers shall be plate and frame type, to provide low temperature hot water for the heating system when supplied with medium temperature hot water at the temperatures and pressures indicated. Temperature and pressure for plate and frame exchangers shall not exceed 138 degrees C (280 degrees F) and 1.93 MPa (280 psig) for medium temperature hot water. Exchangers shall be constructed in accordance with ASME BPVC SEC VIII D1 and certified with ASME stamp secured to unit. U-tube bundles shall be completely removable for cleaning and tube replacement and shall be free to

expand with shell. Shells shall be of seamless steel pipe or welded steel construction and tubes shall be seamless tubing as specified below unless otherwise indicated. Tube connections to plates shall be leakproof. Saddles or cradles shall be provided to mount shell and U-tube exchangers. Frames of plate and frame type exchangers shall be fabricated of carbon steel and finished with baked epoxy enamel.

2.10 SYSTEM EQUIPMENT AND ACCESSORIES

2.10.1 Circulating Pumps

Pumps for hot water shall be of the single-stage centrifugal type, electrically driven. Pumps shall be supported on a concrete foundation as indicated. Pumps shall be either integrally mounted with the motor or direct-connected by means of a flexible-shaft coupling on a cast iron, or steel sub-base. Pump housing shall be of close grained cast iron. Shaft shall be carbon or alloy steel, turned and ground. Shaft seal shall be mechanical-seal or stuffing-box type. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be bronze. Bearings shall be ball-, roller-, or oil-lubricated, bronze-sleeve type, and shall be sealed or isolated to prevent loss of oil or entrance of dirt or water. Motor shall be of a type approved by the manufacturer of the pump.

2.10.2 Controls

The pump shall be controlled automatically by means of the float switch that will automatically start the motor when the water in the receiving tank reaches the high level and stop the motor when the water reaches the low level. Motors shall be provided with magnetic across-the-line starters equipped with general purpose enclosure and Automatic-Manual-Off selector switch in the cover.

2.10.2.1 Factory Testing

The Contractor shall submit a certificate of compliance from the pump manufacturer covering the actual test of the unit and certifying that the equipment complies with the indicated requirements.

2.10.3 Pressure Gauges and Thermometers

Gauges shall be provided for each heat exchanger and piping as indicated. A thermometer and pressure gauge shall be provided on the high temperature water supply and return mains. Thermometers shall be separable socket type.

2.10.4 Vacuum Relief Valve

Vacuum relief valve shall be installed on the shell of each shell and U-tube steam heat exchanger and on the factory supplied steam inlet nozzle of each plate and frame heat exchanger. On shutoff of steam supply and condensing of steam, the vacuum relief valve shall automatically admit air to the heat exchanger.

2.10.5 Pressure Relief Valves

One or more pressure relief valves shall be provided for each heat exchanger in accordance with ASME BPVC SEC VIII D1. The aggregate relieving capacity of the relief valves shall be not less than that required by the above code. Discharge from the valves shall be installed as indicated. Pressure relief valves for steam heat exchangers shall be located on the low temperature water supply coming from near the heat exchanger as indicated. Relief valves for high temperature water heat exchanger shall be installed on the heat exchanger shell.

2.10.6 Drains

A drain connection with 20 mm (3/4 inch) hose bib shall be installed at the lowest point in the low temperature water return main near the heat exchanger. In addition, threaded drain connections with threaded cap or plug shall be installed wherever required for thorough draining of the low temperature water system.

2.10.7 Strainers

Basket or Y-type strainer-body connections shall be the same size as the pipe lines in which the connections are installed. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The body or bottom opening shall be equipped with nipple and gate valve for blowdown. The basket for steam systems shall be of not less than 0.635 mm (0.025 inch) thick stainless steel, or monel with small perforations of sufficient number to provide a net free area through the basket of at least 2.5 times that of the entering pipe. The flow shall be into the basket and out through the perforations.

2.11 INSULATION

Shop and field applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12 FACTORY PAINTED EXPOSED SPACE HEATING EQUIPMENT

Radiator and convector enclosures shall be coated with the manufacturer's standard rust inhibiting primer for painting in the field as specified in Section 09900 PAINTS COATINGS. All other exposed heating equipment shall be painted at the factory with the manufacturer's standard primer and enamel finish.

2.13 HEATING AND VENTILATING UNITS

Heating and ventilating units shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.14 WATER TREATMENT SYSTEM

The water treatment system shall be capable of feeding chemicals into the heating system to prevent corrosion and scale within the heat exchanger and piping system. All water treatment equipment and chemicals shall be furnished and installed by a water treatment company regularly engaged in

the installation of water treatment equipment and the provision of water treatment chemicals based upon water condition analyses. The water treatment company shall provide a water sample analysis taken from the building site, each month for one year.

2.14.1 Chemical Shot Feeder

A shot feeder shall be provided as indicated. Size and capacity of feeder shall be based upon local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping. All materials of construction shall be compatible with the chemicals being used.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as indicated and in accordance with the manufacturer's diagrams and recommendations.

3.2 COLOR CODE MARKING AND FIELD PAINTING

Color code marking, field painting of exposed pipe, and field painting of factory primed equipment shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 WELDING

Welding and nondestructive testing procedures for piping shall be as specified in Section 15216 WELDING, PRESSURE PIPING.

3.4 PIPING

Unless otherwise specified, pipe and fittings installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cuttings or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall be so installed as to permit free expansion and contraction without causing damage to building structure, pipe, joints, or hangers. Changes in direction shall be made with factory made fittings, except that bending of pipe up to 100 mm (4 inches) will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center line radius of bends shall not be less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Vent pipes shall be installed through the roof as indicated and shall be flashed as specified. Horizontal mains shall pitch up or down in the direction of flow as indicated. The grade shall be not less than 25 mm in 12 m. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unions and other

components for copper pipe or tubing shall be brass or bronze. Connections between ferrous and copper piping shall be electrically isolated using dielectric unions.

3.4.1 Joints

Except as otherwise specified, joints used on steel pipe shall be threaded for fittings 25 mm (1 inch) and smaller; threaded or welded for 32 mm (1-1/4 inches) up through 65 mm (2-1/2 inches); and flanged or welded for 80 mm (3 inches) and larger. Joints between sections of copper tubing or copper pipe shall be flared or sweated. Pipe and fittings 32 mm (1-1/4 inches) and larger installed in inaccessible conduits or trenches beneath concrete floor slabs shall be welded. Unless otherwise specified, connections to equipment shall be made with black malleable iron unions for pipe 65 mm (2-1/2 inches) or smaller in diameter, and with flanges for pipe 80 mm (3 inches) or larger in diameter.

3.4.2 Low Temperature Systems

Piping may have threaded, welded, flanged or flared, sweated, or grooved mechanical joints as applicable and as specified. Reducing fittings shall be used for changes in pipe sizes. In horizontal lines, reducing fittings shall be the eccentric type to maintain the top of the adjoining pipes at the same level.

3.4.3 High And Medium Temperature Systems

Temperature systems shall have welded joints to the maximum extent practicable, except screwed joints and fittings may be used at connections to equipment and on piping 65 mm (2-1/2 inches) and smaller. Equipment connections 80 mm (3 inches) and larger shall be flanged. Piping connections 80 mm and larger may be welded or flanged. In horizontal lines, reducing fittings shall be the eccentric type to maintain the tops of adjoining pipes at the same level. Grooved mechanical joints shall not be used.

3.4.4 Threaded Joints

Threaded joints shall be made with tapered threads properly cut, and shall be made tight with PTFE tape complying with ASTM D 3308, or equivalent thread joint compound applied to the male threads only, and in no case to the fittings.

3.4.5 Welded Joints

Joints shall be fusion-welded unless otherwise required. Changes in direction of piping shall be made with welding fittings only. Branch connection may be made with either welding tees or branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains.

3.4.6 Flanged Joints or Unions

Flanged joints or unions shall be provided in each line immediately

preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and similar items. Flanged joints shall be faced true, provided with gaskets, and made square and tight. Full-faced gaskets shall be used with cast iron flanges.

3.4.7 Flared and Sweated Pipe and Tubing

Pipe and tubing shall be cut square and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned with an abrasive before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connection. Installation shall be made in accordance with the manufacturer's recommendations. Changes in direction of piping shall be made with flared or soldered fittings only. Solder and flux shall be lead free. Joints for soldered fittings shall be made with silver solder or 95:5 tin-antimony solder. Cored solder shall not be used. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided on all branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing.

3.4.8 Mechanical Tee Joint

An extracted mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Joints shall be brazed in accordance with NAPHCC NSPC. Soldered joints will not be permitted.

3.4.9 Grooved Joints for Copper Tube

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.5 CONNECTIONS TO EQUIPMENT

Supply and return connections shall be provided by the Contractor unless otherwise indicated. Valves and traps shall be installed in accordance with the manufacturer's recommendations. Unless otherwise indicated, the size of the supply and return pipes to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.5.1 Low Temperature Water Connections

Connections, unless otherwise indicated, shall be made with malleable iron unions for piping 65 mm (2-1/2 inches) or less in diameter and with flanges for pipe 80 mm (3 inches) or more in diameter.

3.5.2 High And Medium Temperature Water Connections

Connections shall be made with 13.8 MPa (2000 pound) black malleable iron unions for pipe 20 mm (3/4 inch) or less in diameter and with flanges for pipe 25 mm (1 inch) and larger in diameter.

3.6 BRANCH CONNECTIONS

Branches shall pitch up or down as indicated, unless otherwise specified. Connection shall be made to insure unrestricted circulation, eliminate air pockets, and permit drainage of the system.

3.6.1 Low Temperature Water Branches

Branches taken from mains shall pitch with a grade of not less than 25 mm in 3 m (1 inch in 10 feet).

3.6.2 High And Medium Temperature Water Branches

Branches shall take off at 45 degrees in the direction of the fluid flow from the supply and return lines and should be branched from the top or upper half of the main line unless otherwise indicated. Abrupt reduction in pipe sizes shall be avoided.

3.7 SUPPORTS

3.7.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. All piping subjected to vertical movement when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers. Where threaded rods are used for support, they shall not be formed or bent.

3.7.1.1 Seismic Requirements for Pipe Supports, Standard Bracing

All piping and attached valves shall be supported and braced to resist seismic loads as specified under Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for supports shall be as specified under Section 05120 STRUCTURAL STEEL.

3.7.1.2 Structural Attachments

Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL.

3.7.1.3 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run.

3.7.2 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle shall be used on all pipe 100 mm (4 inches) and larger.

h. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves.

i. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m, except

that pipe shall be supported not more than 2.4 m from end of risers, and at vent terminations.

j. Type 35 guides using steel, reinforced PTFE or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions and bearing loads encountered. Where steel slides do not require provision for restraint or lateral movement, an alternate guide method may be used. On piping 100 mm (4 inches) and larger, a Type 39 saddle may be welded to the pipe and freely rest on a steel plate. On piping under 100 mm (4 inches), a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate. Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm (4 inches), or by an amount adequate for the insulation, which ever is greater.

k. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

3.7.3 Piping in Trenches

Piping shall be supported as indicated.

3.8 PIPE SLEEVES

3.8.1 Pipe Passing Through Concrete or Masonry

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall provide a minimum of 6 mm annular space between bare pipe or insulation surface and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, cast iron pipe, or galvanized sheet metal with lock-type longitudinal seam and of the metal thickness indicated. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls and floors shall be sealed as indicated and specified in Section 07920 JOINT SEALANTS. Penetrations in fire walls and floors shall be sealed in accordance with Section 07840 FIRESTOPPING.

3.8.2 Pipes Passing Through Waterproofing Membranes

Pipes passing through waterproofing membranes shall be installed through a 19.5 kg/square meter (4 pound) lead-flashing sleeve, a 4.9 kg/square meter (16 ounce) copper sleeve, or a 0.813 mm (0.032 inch) thick aluminum

sleeve, each having an integral skirt or flange. Flashing sleeve shall be suitably formed, and the skirt or flange shall extend 200 mm or more from the pipe and shall be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 50 mm above the highest flood level of the roof or a minimum of 250 mm above the roof, whichever is greater, or 250 mm above the floor. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. At the Contractor's option, pipes up to and including 250 mm (10 inches) in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.8.3 Mechanical Seal Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.8.4 Counterflashing Alternate

As an alternate to caulking and sealing the annular space between the pipe and flashing sleeve or metal-jacket-covered insulation and flashing sleeve, counterflashing may be by standard roof coupling for threaded pipe up to 150 mm (6 inches) in diameter; lead-flashing sleeve for dry vents and turning the sleeve down into the pipe to form a waterproof joint; or tack-welded or banded-metal rain shield round the pipe and sealing as indicated.

3.8.5 Waterproofing Clamping Flange

Pipe passing through wall waterproofing membrane shall be sleeved as specified. In addition, a waterproofing clamping flange shall be installed as indicated.

3.8.6 Fire Seal

Where pipes pass through fire walls, fire partitions, fire rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

3.8.7 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or covered, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe sleeves or to extensions of sleeves without any part of sleeves being visible. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrew.

3.9 ANCHORS

Anchors shall be provided where necessary or indicated to localize expansion or prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed using turnbuckles where required. Supports, anchors, or stays shall not be attached in places where construction will be damaged by installation operations or by the weight or expansion of the pipeline.

3.10 PIPE EXPANSION

The expansion of supply and return pipes shall be provided for by changes in the direction of the run of pipe, by expansion loops, or by expansion joints as indicated. Low temperature water expansion joints may be one of the types specified.

3.10.1 Expansion Loops

Expansion loops shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops shall be cold-sprung and installed where indicated. Pipe guides shall be provided as indicated.

3.10.2 Slip-Tube Joints

Slip-tube type expansion joints shall be used for low temperature water systems only and shall be installed where indicated. The joints shall provide for either single or double slip of the connected pipes as indicated and for the traverse indicated. The joints shall be in accordance with applicable requirements of EJMA Stds and ASME B31.1. End connections shall be flanged. Anchor bases or support bases shall be provided as indicated or required. Initial setting shall be made in accordance with the manufacturer's recommendations to allow for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer, but in any case shall be not more than 1.5 m from expansion joint, except in lines 100 mm (4 inches) or smaller where guides shall be installed not more that 600 mm from the joint.

3.10.3 Bellows-Type Joint

Bellows-type joint design and installation shall comply with EJMA Stds

standards. The joints shall be designed for the working temperature and pressure suitable for the application and shall be not less than 1.03 MPa (150 psig) in any case.

3.10.4 Flexible Ball Joints

Flexible ball joints may be threaded (to 50 mm (2 inches) only), flanged, or welded end as required. The ball-type joint shall be designed and constructed in accordance with the generally accepted engineering principle stated in ASME B31.1, and ASME BPVC SEC VIII D1, where applicable. Flanges shall conform to the diameter and drilling of ASME B16.5. Molded gaskets furnished shall be suitable for the service intended.

3.11 VALVES AND EQUIPMENT ACCESSORIES

3.11.1 Valves and Equipment

Valves shall be installed at the locations shown or specified, and where required for the proper functioning of the system as directed. Gate valves shall be used unless otherwise indicated, specified, or directed. Valves shall be installed with their stems horizontal to or above the main body of the valve. Valves used with ferrous piping shall have threaded or flanged ends and sweat-type connections for copper tubing.

3.11.2 Gravity Flow-Control Valve

The valve to control the flow of water shall be installed in the supply main near the heat exchanger. The valve shall operate so that when the circulating pump starts, the increased pressure within the main will open the valve; when the pump stops, the valve will close. The valve shall be constructed with a cast iron body and shall be provided with a device whereby the valve can be opened manually to allow gravity circulation. The flow-control valve shall be designed for the intended purpose, and shall be installed as recommended by the manufacturer.

3.11.3 Thermometer Socket

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.11.4 Air Vents

Vents shall be installed where indicated, and on all high points and piping offsets where air can collect or pocket.

3.11.4.1 Water Air Vents

Vent discharge lines shall be double-valved with globe valves and shall discharge into a funnel drain.

3.12 UNIT HEATERS

Unit heaters shall be installed as indicated and in accordance with the manufacturer's instructions.

3.13 INSULATION

Thickness of insulation materials for piping and equipment and application shall be in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.14 TESTING AND CLEANING

3.14.1 Pressure Testing

The Contractor shall notify the Contracting Officer 21 days before the tests are to be conducted. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests. Electricity and water will be furnished by the Government. All test results shall be accepted before thermal insulation is installed. The entire low temperature heating system, including heat exchanger, radiators and fittings, shall be hydrostatically tested and proved tight under a pressure of 310 kPa (45 psig) for a period of four hours.

3.14.2 Test of Backflow Prevention Assemblies

Backflow prevention assemblies shall be tested in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

3.14.3 Cleaning

After the hydrostatic and backflow prevention tests have been made and prior to the operating tests, the heat exchanger and piping shall be thoroughly cleaned by filling the system with a solution of 0.5 kg of caustic soda or 0.5 kg of trisodium phosphate per 200 L of water. Observe the proper safety precautions in the handling and use of these chemicals. The water shall be heated to approximately 66 degrees C, and the solution circulated in the system for a period of 48 hours, then drained and the system thoroughly flushed out with fresh water. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. The Contractor shall be responsible for maintaining the system in a clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer.

3.14.4 Water Treatment Testing

3.14.4.1 Water Quality Test

The heating water shall be analyzed prior to the acceptance of the facility by the water treatment company. The analysis shall include the following information recorded in accordance with ASTM D 596.

Date of Sample	_____	
Temperature	_____	degrees C
Silica (SiO_2)	_____	ppm (mg/1)
Insoluble	_____	ppm (mg/1)

Iron and Aluminum Oxides	_____ ppm (mg/1)
Calcium (Ca)	_____ ppm (mg/1)
Magnesium (Mg)	_____ ppm (mg/1)
Sodium and Potassium (Na and K)	_____ ppm (mg/1)
Carbonate (HCO3)	_____ ppm (mg/1)
Sulfate (SO4)	_____ ppm (mg/1)
Chloride (C1)	_____ ppm (mg/1)
Nitrate (NO3)	_____ ppm (mg/1)
Turbidity	_____ unit
pH	_____
Residual Chlorine	_____ ppm (mg/1)
Total Alkalinity	_____ ppm (meq/1)
Noncarbonate Hardness	_____ epm (meq/1
Total Hardness	_____ epm (meq/1)
Dissolved Solids	_____ ppm (mg/1)
Fluorine	_____ ppm (mg/1)
Conductivity	_____ microsiemens/cm

3.15 TESTING, ADJUSTING AND BALANCING

Except as specified herein, testing, adjusting, and balancing shall be in accordance with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.16 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.17 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.18 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 32 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the approved operation and maintenance manuals.

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SECTION 15741

WATER SOURCE HEAT PUMP SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI-ISO 13256-1	(1998) Water-Source Heat Pumps-Testing and Rating for Performance: Part 1 - Water-to-Air and Brine-to-Air Heat Pumps
ARI-ISO 13256-2	(1998) Water-Source Heat Pumps-Testing and Rating for Performance: Part 2 - Water-to-Water and Brine-to-Water Heat Pumps

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.23	(1992; Errata 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI Z21.22	(1999; A 2001) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP	(2001) Fundamentals Handbook,I-P Edition

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2001) Water Pressure Reducing Valves

ASME INTERNATIONAL (ASME)

ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.3	(1999) Malleable Iron Threaded Fittings

ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B31.9	(1996) Building Services Piping
ASME BPVC	(2001) Boiler and Pressure Vessel Codes

ASTM INTERNATIONAL (ASTM)

ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 126	(1995; R 2001) Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2003a) Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 306	(2002) Copper Drainage Tube (DWV)
ASTM B 32	(2003) Solder Metal
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 62	(2002) Composition Bronze or Ounce Metal Castings
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies

INTERNATIONAL GROUND SOURCE HEAT PUMP ASSOCIATION (IGSHPA)

IGSHPA 21010	(1991) Grouting Procedures for Ground-Source Heat Pump Systems

IGSHPA 21020	(1988) Closed-Loop/Ground-Source Heat Pump System/Installation Guide

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2002) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002) Butterfly Valves
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2002) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL 94	(1996; Rev thru Dec 2003) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

Provide heat pump systems complete and ready for operation. Systems include heat pumps, system equipment and condenser. Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.9, ASME B31.5, ASHRAE Hdbk-IP, IGSHPA 21010, IGSHPA 21020, NFPA 70, as supplemented and modified by this section.

1.3 RELATED REQUIREMENTS

Requirements for metal duct systems are specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Product data for integral or appurtenant space temperature controls (STC) supplied with the listed equipment shall include shall include point-to-point electrical wiring diagrams for each STC.

Water-source water-to-air heat pumps; G

Water-source water-to-water heat pumps; G

Plate heat exchangers; G

Specialty valves; G

Expansion tanks

Air separators

SD-06 Test Reports

Piping welds NDE report

Water-source water-to-air heat pumps - field acceptance test planG

Water-source water-to-water heat pumps - field acceptance test plan G,

Plate Heat Exchangers - field acceptance test plan; G

Water-source water-to-air heat pumps - field acceptance test report; G

Water-source water-to-water heat pumps - field acceptance test report; G

Plate Heat Exchangers - field acceptance test reportG

SD-07 Certificates

Employer's record documents

Welding procedures and qualifications

Qualifications of ground heat exchanger fabricators; G

Qualifications of ground heat exchanger installers; G

SD-08 Manufacturer's Instructions

Water-source water-to-air heat pumps - installation instructions

Water-source water-to-water heat pumps - installation instructions

Plate Heat Exchangers - installation instructions

SD-10 Operation and Maintenance Data

Manuals shall feature all relevant engineering units in both English and Metric units.

Water-source water-to-air heat pumps, Data Package 2; G

Water-source water-to-water heat pumps, Data Package 2; G

Plate Heat Exchangers, Data Package 2; G

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

1.5 QUALITY ASSURANCE

1.5.1 Piping Welding Requirements

Provide welding work specified this section for piping systems in conformance with ASME B31.9, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

1.5.2 Employer's Record Documents

Submit to the Contracting Officer for their review and approval the following documentation. This documentation and the subject qualifications shall be in compliance with ASME B31.9.

a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.

b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.

c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

1.5.3 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.5.4 Welding Examinations

Conduct non-destructive examinations (NDE) on piping welds and verify welds meet the acceptance criteria specified in ASME B31.9. NDE on piping welds covered by ASME B31.9 is visual inspection only. Submit a piping welds NDE report meeting the requirements specified in ASME B31.9.

PART 2 PRODUCTS

2.1 EQUIPMENT

Equipment using refrigerants R-11, R-12, R-113, R-114, R-115, R-500, or refrigerants with ozone depletion factor (ODF) greater than 0.05 will not be permitted.

2.1.1 Water-Source Water-to-Air Heat Pumps (WAHP)

Provide water-source water-to-air heat pump units factory assembled, designed, tested, and rated in accordance with ARI-ISO 13256-1. Units shall be ARI certified, or listed in ARI directory. Units shall include fans, refrigerant-to-air heat exchangers, filters, dampers, compressor, reversing valve, expansion valve, refrigerant-to-water heat exchangers, hose kits, and controls. Provide units with factory installed sound attenuation package. A permanent label shall be affixed to each heat pump unit indicating basic information for that unit. The information shall include: nominal flow rate l/s, pressure drop kPa, temperature drop/rise degree C, and capacity W.

a. Cabinet: Provide manufacturer's standard zinc coated galvanized steel cabinet. Provide 16 gauge single wall front panel. Provide access panels for inspection and access to internal parts. Provide lengthwise unit base stiffeners. Insulate cabinet with minimum 12 mm multi-density, fiberglass insulation with exposed edges sealed

or tucked under flanges to prevent introduction of fibers into the airstream. Provide foam gasket sealant around compressor and end panel perimeters. Female threaded pipe condensate drain connections, supply water connections, and return water connections shall be copper threaded fittings mechanically fastened to the cabinet. Water piping shall be insulated. Construct cabinet with compartments and locate the compressor, reversing valve, and water coil out of the airstream. The control box shall be located within the unit.

b. Fans: Provide centrifugal type, direct drive fans with permanently lubricated motors. Motors shall be permanent split capacitor (PSC) type with thermal overload protection.

c. Refrigerant-to-Air Heat Exchanger: Provide coil constructed of rifled copper tubes with plate aluminum fins designed for refrigerant working pressure of 3102 kPa. The condensate drain pan shall be epoxy coated and insulated. Provide drain pan with overflow protection.

d. Filter Section: Provide replaceable (throwaway)25 mm thick UL listed fiberglass type filters with standard dust-holding capacity. Mount filters in filter frames and provide access panels or doors for removal and replacement of filters.

e. Compressor: Provide hermetically sealed type compressor, installed on vibration isolators enclosed in a 16 gauge compressor enclosure with 13mm acoustical insulation. Provide 12-gauge compressor/water-to-refrigerant heat exchanger pan with second stage of vibration isolation.Provide high and low pressure switches, low suction temperature cut-out, motor thermal overload protection, 5 minute anti-recycle timer, and start capacitor kit. Provide capability to reset compressor lockout circuit at the remote thermostat and at the disconnect. Provide compressor discharge muffler.

f. Reversing Valve: Provide solenoid activated refrigerant reversing valves energized only during the cooling mode and designed to fail in the heating position.

g. Refrigerant-to-Water Heat Exchangers: Provide refrigerant-to-water heat exchangers of coaxial type, with inner cupronickel water tube and outer steel refrigerant tube. Heat exchanger shall be tested and rated for 3102 kPa refrigerant working pressure. A parallel capillary tube/thermal expansion valve assembly shall provide superheat over -4 to 43 degree C liquid temperature range. Provide water-to-refrigerant heat exchanger vibration isolation

h. Emergency Heater: Provide UL or ETL listed, electric resistance heater with internal fusing integral with heat pump unit; fan shall run until heater cools. Locate downstream of indoor coil.

i. Hose Kits: Kits shall include two 0.6 m long metal braided hoses

with swivel connectors on one end, an manual flow control valve with test ports, two shutoff ball valves with memory stops (one with test port), blow down ball valve, and Y-strainer. Hoses shall be fire rated to meet UL 94. Hoses shall have a maximum working pressure of 2067 kPa.

j. Hanger Kits: Provide horizontal units with hanger kits consisting of galvanized steel brackets, bolts, washers, and vibration isolators. The hanger kit shall be designed to support the unit from below and suspend from threaded rods.

k. Controls: Controls and safety devices shall be factory wired and mounted within the control box of the unit cabinet.

Provide a microprocessor based controller that communicates with an electronic multi-stage space thermostat. The microprocessor shall control sequencing, high and low pressure switch monitoring, freeze protection, lockout control, night setback, emergency shutdown, short cycle protection, random start, LED mode and fault indicators, fault memory, input and output diagnostics, and a communications port. Provide a factory-installed low voltage terminal block for field control wiring and a low voltage transformer. Provide communications capability for remote direct digital control (DDC). Provide a hand held, remote service terminal from the heat pump manufacturer capable of interfacing with heat pump unit microprocessor controller to perform diagnostics, data retrieval, and calibration functions.

l. Space Temperature Controls: Provide electronic multi-stage, auto-changeover, adjustable thermostats with OFF-HEAT-AUTO-COOL-EMERGENCY system switch and AUTO-ON fan switch. Thermostats shall be furnished by the unit manufacturer. Provide relays, transformers, contractors, and control wiring between thermostats and unit. Thermostats shall read out in degrees C and degrees F.

2.1.2 Water-Source Water-to-Water Heat Pumps (WWHP)

Provide water-source water-to-water heat pump units factory assembled, designed, tested, and rated in accordance with ARI-ISO 13256-2. Units shall be listed by ETL, or listed in ARI directory. Units shall include compressor, reversing valve, expansion valve, refrigerant-to-water condensing coil, refrigerant-to-water evaporator coil, desuperheater, hose kits, and controls.

a. Cabinet: Provide manufacturer's standard galvanized steel cabinet finished with corrosion resistant epoxy coating or lacquer acrylic. Provide access panels for inspection and access to internal parts. Insulate cabinet with minimum 12 mm multi-density, fiberglass insulation. Provide copper or stainless steel female threaded pipe connections for supply water and return water connections; these connections shall be mechanically fastened to the cabinet. Water piping shall be insulated.

b. Compressor: Provide hermetically sealed type compressor, installed on vibration isolators enclosed in an acoustically treated enclosure. Provide high and low pressure switches, low suction temperature cut-out, motor thermal overload protection, 5 minute anti-recycle timer, and start capacitor kit. Provide capability to reset compressor lockout circuit at the remote thermostat and at the disconnect. Provide units with factory installed sound attenuation package.

c. Reversing Valve: Provide solenoid activated refrigerant reversing valves energized only during the cooling mode and designed to fail in the heating position.

d. Refrigerant-to-Water Heat Exchangers: Provide refrigerant-to-water heat exchangers of coaxial type, with inner cupronickel water tube and outer steel refrigerant tube. Heat exchanger shall be tested and rated for 3102 kPa refrigerant working pressure. A parallel capillary tube/thermal expansion valve assembly shall provide superheat over -4 to 49 degree C liquid temperature range. Refrigerant-to-water heat exchangers and refrigerant piping shall be insulated to prevent condensation on the piping containing low temperature water.

e. Hose Kits: Kits shall include two 0.6 m long metal braided hoses with swivel connectors on one end, an flow control valve with test ports, two shutoff ball valves with memory stops (one with test port), blow down ball valve, and Y-strainer. Hoses shall be fire rated to meet UL 94. Hoses shall have a maximum working pressure of 2067 kPa.

f. Controls: Controls and safety devices shall be factory wired and mounted within the control box of the unit cabinet.

(1) Provide a microprocessor based controller. The microprocessor shall control sequencing, high and low pressure switch monitoring, freeze protection, lockout control, night setback, emergency shutdown, short cycle protection, random start, LED mode and fault indicators, fault memory, input and output diagnostics, and a communications port. Provide a factory-installed low voltage terminal block for field control wiring and a low voltage transformer. Provide communications capability for remote direct digital control (DDC). Provide a hand held, remote service terminal from the heat pump manufacturer capable of interfacing with heat pump unit microprocessor controller to perform diagnostics, data retrieval, and calibration functions.

g. Space Temperature Controls: Provide electronic multi-stage, auto-changeover, adjustable thermostats with OFF-HEAT-AUTO-COOL-EMERGENCY system switch and AUTO-ON fan switch. Thermostats shall be furnished by the unit manufacturer. Provide relays, transformers, contractors, and control wiring between thermostats and unit. Thermostats shall read out in degrees C and degrees F.

2.1.3 Console Water-Source Water-to-Air Heat Pumps (WAHP)

Provide console water-source water-to-air heat pump units factory assembled, designed, tested, and rated in accordance with ARI-ISO 13256-1. Units shall be ARI certified, or listed in ARI directory. Units shall include fans, refrigerant-to-air heat exchangers, filters, dampers, compressor, reversing valve, expansion valve, refrigerant-to-water heat exchangers, hose kits, and controls. Provide units with factory installed sound attenuation package. A permanent label shall be affixed to each heat pump unit indicating basic information for that unit. The information shall include: nominal flow rate l/s, pressure drop kPa, temperature drop/rise degree C, and capacity W.

a. Cabinet: Provide galvanized steel cabinet with appliance grade electrostatic powder paint finish. Provide access panels for inspection and access to internal parts. Insulate cabinet with minimum 12 mm multi-density, fiberglass insulation with exposed edges sealed or tucked under flanges to prevent introduction of fibers into the airstream. Water piping shall be insulated. Provide cabinet with heavy gauge base assembly and maximum sized return air opening and filter sizing. Construct cabinet with compartments and locate the compressor, reversing valve, and water coil out of the airstream. The control box shall be located within the unit.

b. Fans: Provide centrifugal type, direct drive fans with permanently lubricated motors. Motors shall be permanent split capacitor (PSC) type with thermal overload protection.

c. Refrigerant-to-Air Heat Exchanger: Provide coil constructed of rifled copper tubes with plate aluminum fins designed for refrigerant working pressure of 3102 kPa. The condensate drain pan shall be epoxy coated and insulated. Provide drain pan with overflow protection.

d. Filter Section: Provide replaceable (throwaway)25 mm thick UL listed fiberglass type filters with standard dust-holding capacity. Mount filters in filter frames and provide access panels or doors for removal and replacement of filters.

e. Compressor: Provide hermetically sealed type compressor, installed on two stage vibration isolation system with 12-gauge intermediate mounting plates. Provide lined compressor enclosure. Provide high and low pressure switches, low suction temperature cut-out, motor thermal overload protection, 5 minute anti-recycle timer, and start capacitor kit. Provide capability to reset compressor lockout circuit at the remote thermostat and at the disconnect. Provide compressor discharge muffler.

f. Reversing Valve: Provide solenoid activated refrigerant reversing valves energized only during the cooling mode and designed to fail in the heating position.

g. Refrigerant-to-Water Heat Exchangers: Provide refrigerant-to-water heat exchangers of coaxial type, with inner cupronickel water tube and outer steel refrigerant tube. Heat exchanger shall be tested and rated for 3102 kPa refrigerant working pressure. A parallel capillary tube/thermal expansion valve assembly shall provide superheat over -4 to 43 degree C liquid temperature range. Provide water-to-refrigerant heat exchanger vibration isolation

h. Hose Kits: Kits shall include two 0.6 m long metal braided hoses with swivel connectors on one end, an manual flow control valve with test ports, two shutoff ball valves with memory stops (one with test port), blow down ball valve, and Y-strainer. Hoses shall be fire rated to meet UL 94. Hoses shall have a maximum working pressure of 2067 kPa.

i. Controls: Controls and safety devices shall be factory wired and mounted within the control box of the unit cabinet.

   Provide a microprocessor based controller that communicates with an electronic multi-stage space thermostat. The microprocessor shall control sequencing, high and low pressure switch monitoring, freeze protection, lockout control, night setback, emergency shutdown, short cycle protection, random start, LED mode and fault indicators, fault memory, input and output diagnostics, and a communications port. Provide a factory-installed low voltage terminal block for field control wiring and a low voltage transformer. Provide communications capability for remote direct digital control (DDC). Provide a hand held, remote service terminal from the heat pump manufacturer capable of interfacing with heat pump unit microprocessor controller to perform diagnostics, data retrieval, and calibration functions.

j. Space Temperature Controls: Provide electronic multi-stage, auto-changeover, adjustable thermostats with OFF-HEAT-AUTO-COOL-EMERGENCY system switch and AUTO-ON fan switch. Thermostats shall be furnished by the unit manufacturer. Provide relays, transformers, contractors, and control wiring between thermostats and unit. Thermostats shall read out in degrees C and degrees F.

2.1.4 Plate Heat Exchangers

Echanger shall be of the multipass arrangement. Plates, frames, and gaskets shall be designed for a working pressure of 2.07 MPa and factory tested at 31.0 MPa. Medium temperature water, low temperature water, and pressure relief valve connections shall be located in accordance with the manufacturer's standard practice. Connections larger than 80 mm shall be ASME 2.07 MPa flanged. Plates shall be corrugated type 304 stainless steel. Plate hanger shall be 304 stainless steel. Frame shall be carbon steel finished with corrosion resistant epoxy paint.

2.1.5 Pumps

2.1.5.1 In-Line Pumps

Provide pumps constructed of manufacturer's standard materials suitable for chilled water and hot water heating systems. Pumps shall have mechanical seals and drip-proof electric motors.

2.1.5.2 End Suction Water Pumps

Pumps shall be single stage centrifugal, with mechanical seals and drip-proof electric motors. Impeller shall be bronze. Other pump parts shall be manufacturer's standard materials provided with bronze impeller pump. Provide threaded suction and discharge pressure gage tapping with square-head plugs. Provide flexible coupling with steel cover guard on base-mounted pumps. Base-mounted pump, coupling guard, and motor shall each be bolted to a fabricated steel base which shall have bolt holes for securing base to supporting surface. Close-coupled pump shall be provided with integrally cast or fabricated steel feet with bolt holes for securing feet to supporting surface.

Provide pump suction diffuser. Pump casing shall include an angle type body of cast iron. Unit shall have internal straightening vanes, strainer with minimum 6.35 mm openings, and auxiliary disposable fine mesh strainer which shall be removed 30 days after start-up. Provide warning tag for operator indicating scheduled date for removal. Casing shall have connection sizes to match pump suction and pipe sizes, and be provided with adjustable support foot or support foot boss to relieve piping strains at pump suction. Blowdown port and plug shall be provided on unit casing. Provide a magnetic insert to remove debris from system.

2.1.5.3 Pump Modules

Provide pump module units factory designed, assembled, and pressure tested. Units shall include flanged pumps, brass fill and purge valves, quick release fill and purge ports, pressure/temperature (Pete's) plug, wiring, and fuse protection. Pumps shall be the wet rotor and single stage types, with pump casings thermally insulated. Provide manufacturer's standard galvanized steel cabinet, finished with corrosion resistant epoxy paint. Pump module units shall be provided by the ground source, closed loop heat pump manufacturer.

2.2 ELECTRICAL

2.2.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 16415 ELECTRICAL WORK, INTERIOR. Provide electrical connections under Section 16415 ELECTRICAL WORK, INTERIOR. Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

2.2.2 Electrical Work

Provide in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Provide control wiring in accordance with Section 15910 DIRECT DIGITAL CONTROL SYSTEMS.

2.3 ABOVEGROUND PIPING SYSTEMS

Provide the following pipe and fittings. Provide dielectric fittings, unions, or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions, or flanges. Water piping sizes 100 mmand smaller shall be copper tubing. Water piping sizes larger than 100 mm shall be copper tubing or steel piping.

2.3.1 Copper Tubing Systems

Provide copper tubing for the following systems.

a. Copper condensate drain piping from drain pans.

b. Chilled/Hot Water Piping.

2.3.1.1 Copper Condensate Drain Piping

Provide copper tubing in accordance with ASTM B 88M, Type L or M for piping sizes 25 mm and smaller. Provide ASTM B 306 copper tubing and ANSI B16.23 solder joint fittings for piping sizes larger than 25 mm. In lieu of copper tubing, 32 mm Schedule 40 polyvinyl chloride (PVC) plastic pipe, fittings, and solvent cement may be provided.

2.3.1.2 Soldered Joint Copper Tubing Systems

For chilled/hot water piping, provide ASTM B 88M, Type L or M for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME B16.22 solder joint fittings, unions, and flanges; provide adapters as required. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony (Sn-Pb) solder.

2.3.2 Steel Piping Systems

Provide steel piping for the following piping systems.

a. Chilled/Hot Water Piping.

2.3.2.1 Steel Pipe

Provide ASTM A 53 Type E or Type S, or ASTM A 106 steel pipe; except ASTM A 53, Type F steel pipe may be provided for water pipe sizes larger than 100 mm. Provide Weight Class STD or Schedule No. 40 black steel pipe for welding end connections. Provide Weight Class XS or Schedule No. 80 black steel pipe for threaded end connections.

2.3.2.2 Steel Pipe Fittings

Provide ASME B16.3 or ASME B16.11 threaded fittings, and ASME B16.39 threaded unions. Provide ASME B16.9 buttwelding fittings of the same material and weight as the piping in which fittings are installed; provide backing rings compatible with piping materials being butt welded. Provide ASME B16.11 socket welding fittings.

2.3.2.3 Steel Pipe Unions

Provide ASME B16.39, Class 1034, unions with threaded end connections on one side of threaded valve in steel piping systems.

2.3.2.4 Steel Pipe Flanges

Provide ASME B16.5, Class 1034 welding neck flanges. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.

a. Gaskets: Provide one piece factory cut gaskets suitable for the intended service. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.

b. Bolts: Provide ASTM A 193/A 193M, Grade B7 bolts.

c. Nuts: ASTM A 194/A 194M, Grade 7.

d. Washers: Provide steel flat circular washers under bolt heads and nuts.

2.3.3 Valves

Valves shall have flanged end connections, except valves smaller than 65 mm may have threaded end connections with a union on one side of the valve. Solder end connections may be used for connections between copper alloy valves and copper tubing.

2.3.3.1 Gate Valves

MSS SP-80, Class 862, except sizes 65 mm and larger shall conform to MSS SP-70, Class 862.

2.3.3.2 Globe and Angle Valves

MSS SP-80, Class 862, except sizes 65 mm and larger shall conform to MSS SP-85, Class 862.

2.3.3.3 Check Valves

MSS SP-80, Class 862, swing check; except sizes 65 mm and larger shall conform to MSS SP-71, Class 862.

2.3.3.4 Butterfly Valves

MSS SP-67, except sizes 65 mm and larger shall have lugged or wafer body designed for installation between ASME Class 1034 flanges. Valves shall

have two-position lever handles.

2.3.3.5 Ball Valves

Full port design, copper alloy body, except sizes 65 mmand larger shall be cast-iron body. Valves shall have two-position lever handles unless indicated otherwise. Ball valves may be provided in lieu of butterfly valves and gate valves.

2.3.3.6 Vent Valves

Provide manual vent valves designed to be operated manually with screwdriver or thumbscrew, 6 mm NPS connection. The valve material shall be compatible with the working fluid (antifreeze).

2.3.3.7 Water Relief Valves

Provide water relief valves as indicated, and in accordance with ASME BPVC. Bronze body, test level, ASME rated. Pressure relief at 207 kPa.

2.3.4 Specialty Valves

2.3.4.1 Combination Pressure and Temperature Relief Valves

ANSI Z21.22, copper alloy body, automatic reseating, with test lever. Discharge capacity pressure relief setting shall be 862 kPa and temperature setting of 85 degrees C based on AGA temperature steam rating.

2.3.4.2 Water Pressure Reducing Valves

ASSE 1003, copper alloy body, automatic reseating, with test lever.

2.3.4.3 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

2.3.4.4 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy, or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 862 kPa (gage) at 87.8 degrees C hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tappings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the liters per second flow for each differential pressure reading.

2.3.4.5 Backflow Prevention Assemblies

Provide reduced pressure principle type backflow prevention assemblies which are approved by and have a current "Certificate of Approval" from the FCCCHR List. Listing of the particular make, model/design, and size in the

current FCCCHR List will be acceptable as the required proof.

2.4 PIPING ACCESSORIES

2.4.1 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69. Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shields for insulated piping.

2.4.2 Strainers

ASTM A 126, Class B, flanged iron body, for 65 mm and larger. ASTM B 62, cast iron or bronze for 50 mm and smaller. Provide basket or Y type. Tee type is acceptable for water service. Provide screens constructed of bronze, monel metal, or 18-8 stainless steel, free area not less than 2.5 times pipe area, with perforations as follows:

a. 80 mm and smaller: 1.1 mm diameter perforations for liquids.

b. 100 mm and larger: 3.2 mm diameter perforations for liquids.

2.4.3 Pressure Gages

Provide single style pressure gage with 115 mm dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range for intended service.

2.4.4 Pressure/Temperature Test Provisions

2.4.4.1 Pete's Plug

Provide 15 mm MPT by 75 mm long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

2.4.4.2 Testing Accessories

Provide one each of the following test items to the Contracting Officer:

a. 8 mm FPT by 3.2 mm diameter stainless steel pressure gage adapter probe for extra long test plug.

b. 90 mm diameter, one percent accuracy, compound pressure gage, 0 to 1378 kPa range.

c. -29 to 49 degree C pocket thermometer one-half degree accuracy, 25 mm dial, 127 mm long stainless steel stem, plastic case.

2.4.5 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 75 mm diameter dial with glass face gasketed within the case; and accuracy within 2 percent of scale range. Provide scale range for intended service.

2.4.6 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

2.4.7 Expansion Tanks

Construct of steel for minimum working pressure of 862 kPa (gage). Tank shall have polypropylene or butyl lined diaphragm which keeps the air charge separated from the water.

2.4.8 Air Separators

Provide tangential inlet and outlet connections, blowdown connections, and internal perforated stainless steel air collector tube to direct released air to automatic air vent. Construct of steel for minimum working pressure of 862 kPa (gage).

2.4.9 Pipe Sleeves

Except as indicated otherwise, provide pipe sleeves as specified in this section. Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide 25 mm minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.4.9.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.4.9.2 Sleeves Not in Masonry and Concrete

Provide 0.55 mm thick galvanized steel sheet pipe sleeves.

2.4.10 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.5 ACCESS DOORS FOR VALVES

Provide factory fabricated and primed flush face steel access doors including steel door frame equipped with continuous hinges and turn-screw-operated latch. Provide door frame installation in plaster and masonry walls.

2.6 AUXILIARY DRAIN PAN, DRAIN CONNECTIONS, AND DRAIN LINES

Provide galvanized steel auxiliary drain pans under units where indicated. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 15400 PLUMBING SYSTEMS.

2.7 CHEMICAL FEED TANK

Construct of steel for minimum working pressure of 862 kPa (gage). Provide chemical pipe, fittings, and valves as specified for water piping.

2.7.1 Aboveground Condenser Water Piping System

Add borate-nitrite corrosion inhibitors, acceptable to heat pump component manufacturers (and plastic radiant floor tubing?), to initial fill water for heating and cooling water systems in concentrations of 0.0039 liter/liter of system water.2.7.2 Chilled/Hot Water Piping System

Add borate-nitrite corrosion inhibitors, acceptable to heat pump component manufacturers, to initial fill water for heating and cooling water systems in concentrations of 0.0039 liter/liter of system water.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Heat Pump System

Maintenance access to each piece of equipment shall not be compromised by any type of piping, electrical conduit, or any other utility. Further, install equipment in accordance with the manufacturer's written installation instructions, including the following:

Water-source water-to-air heat pumps - installation instructions

Water-source water-to-water heat pumps - installation instructions

Plate Heat Exchangers - installation instructions

3.1.2 Connections to Existing Systems

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems. Flush existing systems in accordance with paragraph entitled "Flushing the Ground Heat Exchanger" prior to making connections.

3.2 ABOVEGROUND PIPING

Provide unions in piping to facilitate removal of heat pump for maintenance or replacement. Test, inspect, and approve piping before covering or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

a. Threaded Connections: Threaded joints shall be sealed with a sealant compatible with the circulating fluid; use of Teflon tape is not permitted. Do not thread metal pipe into plastic piping.

b. Pipe Hangers and Supports: Install in accordance with MSS SP-69. Provide additional pipe hangers and supports at in-line water pumps and flanged valves.

c. Piping to Receive Insulation: Provide temporary wood spacers between the pipe hangers and supports, and the pipe to properly slope the piping and establish final elevations. Provide temporary wood spacers of same thickness as insulation to be provided under Section 15080 MECHANICAL INSULATION.

d. Cleaning of Piping: Keep interior and ends of new piping and existing piping, affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

3.2.1 Flushing the Aboveground Piping

Flush the entire piping system thoroughly in accordance with IGSHPA 21020 recommendations and leave filled with clean water.

3.3 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Adjust and balance air duct

systems so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.4 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of water source heat pump manufacturer's technical representative for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.

3.5 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish fuel, water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

3.5.1 Piping Systems Except for Ground Heat Exchanger and Refrigerant

Before insulating, hydrostatically test each new piping system at not less than 1278 kPa. Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.

3.5.2 Equipment Tests

3.5.2.1 Field Testing

Test each item of equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with each equipment manufacturer's recommendation. Verify that each item of equipment operating parameters are within limits recommended by the manufacturer.

3.5.2.2 Field Test Plans

Furnish water-source heat pump field test plans developed by each equipment manufacturer detailing recommended field test procedures for each item of equipment. Field test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment will not be acceptable. The Contracting Officer will review and approve the field test plan for each item of equipment listed below prior to commencement of field testing of the equipment.

a. Equipment Items to Test:

Water-source water-to-air heat pumps - field acceptance test plan

Water-source water-to-water heat pumps - field acceptance test plan

Plate Heat Exchangers - field acceptance test plan

b. Coordinated Testing: Indicate in each field test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of equipment controls which interlock and interface with controls factory prewired or external controls for the equipment provided under Section 15910 DIRECT DIGITAL CONTROL SYSTEMS.

c. Prerequisite Testing: Equipment for which performance testing is dependent upon the completion of the work covered by Section 15990 TESTING,ADJUSTING, AND BALANCING OF HVAC SYSTEMS shall have that work completed as a prerequisite to testing work under this section. Indicate in each field test plan when such prerequisite work is required.

d. Test Procedure: Indicate in each field test plan each equipment manufacturer's published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer. Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Structure procedures to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

e. Performance Variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Furnish with each test procedure a description of acceptable results that have been verified. Identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.

f. Job Specific: Each test plan shall be job specific and shall address the particular item of equipment and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.

g. Specialized Components: Each test plan shall include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.5.2.3 Field Test Reports

a. Equipment Items to Test:

Water-source water-to-air heat pumps - field acceptance test report

Water-source water-to-water heat pumps - field acceptance test report

Plate Heat Exchangers - field acceptance test report

b. Manufacturer's Recommended Test: Conduct the manufacturer's recommended field testing in compliance with the approved test plan specified above. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field testing.

c. Operational Test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every 2 hours. Use the test report forms for logging the operational variables.

d. Notice of Tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.

e. Report Forms: Type data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC Manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.

f. Deficiency Resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested to verify compliance.

3.5.3 Additional Field Testing

Requirements for testing, adjusting, and balancing (TAB) of ducts, piping, and equipment are specified in Section 15990 TESTING,ADJUSTING, AND BALANCING OF HVAC SYSTEMS .

Balance air flows to that indicated in accordance with SMACNA HVAC Duct Const Stds, as supplemented and modified by this section. Submit written certificate to report the following:

a. Water source heat pump unit nameplate data, and actual voltage and ampere consumption.

b. Supply and return terminal airflow, and equipment used to measure airflow.

c. Water source heat pump liters/sec and entering and leaving air temperatures.

d. Water source heat pump unit condenser water liters/sec and entering and leaving temperatures.

e. Ambient outside air temperature, date, and person testing, balancing, and reporting.

-- End of Section --

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Section 15750

RADIANT FLOOR HEATING AND COOLING SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

Provide a new hot water radiant floor heating system of the size, capacity, material, and configuration where and as denoted on the drawings and herein specified. System furnishings and installation shall conform to guidelines outlined herein.

1.1.1 Types of radiant floor heating installation:

Concrete Slab - Tubing shall be installed in a concrete pad with a 6" thickness or as indicated. Tubing must have a minimum concrete coverage of a 2" on top of the tubing. Tubing shall be secured in place by fastening the tubing to the concrete rebar or rewire using plastic zip ties. Tubing shall be secured in place to the satisfaction of the Contracting Officer's representative prior to pour.

1.2 SECTION INCLUDES:

A. Radiant System Material

B. Radiant Heat Transfer Package

1.3 QUALITY ASSURANCE:

All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified, or as denoted on the drawings.

System components shall be UL listed.

Ensure equipment pressure ratings are at least equal to system's maximum operating pressure at point where installed, but not less than specified.

Equipment manufacturer shall be a company specializing in manufacture, assembly, and field performance of provided equipment with a minimum of 3 years experience.

Equipment provider shall be responsible for providing equipment start-up and, when noted, an in the field certified training session. New equipment start-up shall be for the purpose of inspecting equipment installation manner and control system start-up. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

1.4 PRODUCT HANDLING:

1.4.1 Replacement and Repair:

All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Contracting Officer's Representative.

1.5 REGULATORY REQUIREMENTS:

A. Conform to International Mechanical Code

B. Conform to BOCA National Building Code

C. Conform to BOCA National Fire Protection Code

D. Conform to National Electric Code NFPA 70

E. Conform to Radiant Panel Association installation standards

F. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.6 SUBMITTAL:

Submit each item in this article according to the Conditions of the Contract and Division 1 Specification Sections.

Submit manufacturer's installation instructions under provisions of General Conditions and Division 1.

Submit shop drawings and calculations reflecting the intended tubing layout including indicated manifold locations and zones. Supplier of piping may propose alternate tubing layouts, however the manifold locations and sizes shall remain unchanged.

Submit product data including dimensions, temperature capacities (both constant and intermittent), pressure ratings (both operating and burst), material composition, design criteria (including: heat loss calculations, lengths, design flows, pressure drops, and bend radius), furnished specialties, controls, and accessories.

Submit control providers sequence of operation for the radiant heating operation, if not previously described in the temperature controls division of the specification. Control sequence of operation shall be provided to outline the system's overall design sequence. The written sequence of operation shall include description of operation and logic, along with a piping and wiring schematic.

Tubing installation, layout, and maintenance data requirements should follow the recommendations in the manufacturer's installation instructions.

1.7 OPERATION AND MAINTENANCE DATA:

Submit Operation and Maintenance information under provisions of Division 15 "Mechanical General Requirements" and the provisions of the General Conditions and Division 1.

Operation and Maintenance Data: Include installation instructions.

Under provisions of commissioning documentation; testing of equipment, as well as training of owner's operation and maintenance personnel may be required in cooperation with the commissioning consultant.

1.8 DELIVERY, STORAGE, AND HANDLING:

Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

Radiant tubing material shall be capable of withstanding exposure to direct sunlight without degradation for a period of at least a 120 days prior to installation.

Radiant tubing material shall be capable of being installed directly on conventional base rock or sand fill material. Tubing shall be able to withstand typical installation handling, such as, dragging across fill material or rewire/rebar, pulling through drilled holes, staple affixing, walking on, wheelbarrow tire exposure, and kinking. Tubing shall regain its original shape naturally after any kinking without the use of applied heat or physical repair.

1.9 WARRANTY:

Provide a minimum twenty (10) year non-prorated commercial warranty on materials.

PART 2 PRODUCTS

2.1 RADIANT SYSTEM MATERIALS:

2.1.1 Radiant Tubing Material:

Tubing shall be of a spiral braided multi-composite design constructed of an inner tube, an aluminum solid oxygen diffusion barrier, a contour extrusion layer, a reinforcing fiber, and an outer cover. Tubing shall be UV-resistant, so as not to degrade when exposed to continuous sunlight. Tubing shall be rated for continuous working pressures of 100 PSI and 210 F, a burst pressure of not less than 800 PSI at 70°F, and shall be capable of withstand temperatures of -50 F to 325 F intermittently.

Tubing shall be UL listed to 180 F and shall remain flexible at temperatures down to -35 F.

Tubing shall have an oxygen permeation inhibitor. The oxygen barrier shall be completely encapsulated in the tubing, protected by the outside cover. The oxygen barrier shall be made of a solid aluminum material and shall maintain an oxygen permeation rate less than 1 mg oxygen/liter of fluid/day

at 40 F; this resistance rating shall be consistent across the entire UL temperature rating (0 - 180 F).

Tubing shall be crush proof, recovering its original cross section area after flattening due to construction, site, or instillation abuse.

Tubing layout shall be based on using multiple equal length tubes off of the same manifold.

Tubing installation style, layout, and affixing method shall be as shown on plans and installation drawings.

2.1.2 Manifolds:

The radiant tubing manufacturer shall provide custom manifolds having the correct size and number of connections as noted on the installation drawings. Manifolds shall be sized to handle the specified flow capacity of the area it serves and shall be sized adequately to not create localized velocity noises. Manifold locations shall be as indicated; changes in footprint, size or location must be coordinated with the various subs in advance, and be approved by the contracting officer as part of the submittal process prior to the start of any actual construction.

Manifolds shall be constructed of either a brass or copper material and at a minimum shall consist of a separate supply and return manifold with the correct number of tubing connections per unit, installed balancing ball valves on each supply and return connection, union connections, a means to directly read temperature and flow at each circuit, and a vent and purge assembly. Temperature readings may be provided via a thermowell and removable thermometer. A minimum of two thermometers shall be provided at each manifold.

Manifold trunks shall be constructed of either brass and copper (type L) with copper or brass base branches with brass tee (sweat) branches or brass ZT barbs, soldered with high strength solder. Manifolds shall be provided in standard diameters, as shown on drawings, between 1" - 4" in size. Manifolds shall be fitted with unions, a vent and purge assembly, and ball valves for flow control and isolation purposes. Where noted on drawings manifolds may require additional components in addition or in substitution to those noted above including electric or manual zone valves, main line isolation valves, or visual flow indicators in order to further enhance system installation and performance.

Alternate manifold configurations shall use built-up factory standard components; configuration must meet installation concept including physical footprint, and be provided by the radiant tubing manufacturer.

Tubing shall be connected to the manifolds without the need for adhesives or special tools. Each tubing connection shall be secured to the manifold via a brass barb fitting and a Selftite tension clamp. On systems utilizing PEX type materials compression type couplings shall be used to fasten each length of tube to the manifold.

During start-up each manifold set shall be connected to a pressure test kit

for field verified testing and system fill/purging.

2.1.3 Accessories

Radiant tubing manufacturer shall provide additional installation components necessary to facilitate the radiant tubing installation including but not limited to:

a. Six of field repair kits

b. Adequate cable ties

c. Staple gun and staples

d. Manifold mounting brackets

e. Pressure test kit

f. Hose unwinder

2.2 RADIANT HEAT TRANSFER PACKAGE:

2.2.1 General:

The pumping and control package shall include the controls, pumping equipment, air elimination devices, controlled devices, and heat transfer devices (when necessary) required to integrate a system with supply water and individual temperature zonal requirements in one functional control package adequate to the needs of the four manifolds.

Wiring and piping for field installation of the circulation pumps, balancing valves, controls, thermostats, and associated equipment shall be the responsibility of the contractor. A written sequence of operation shall be provided by the manufacturer.

The radiant floor system shall be completed such that:

a. Supply and return lines to and form the heat source/sink is connected and tested;

b. Supply and return lines to and form each zone manifold set is connected and tested;

c. Supply power is provided within the Mechanical Room to the floor heating control package;

d. Remote Room Thermostat Units (RTU) are installed, one per zone, and wired back to the control package.

e. An outdoor sensor, as shown on the drawings, is mounted and wired back to the controller. As a minimum, an interlock capability shall be provided to the Lonworks building DDC system to prevent radiant floor system operation when the DDC temperature status is satisfied. See Section 15910.

f. The sequence of operation for the radiant floor system shall reflect that indicated on the control drawings.

The contractor shall provide a fully integrated and completed system for distribution, balancing, flow and temperature control of heating and cooling water within the floor mounted tubing. This shall include provisions for automatic, seasonal change-over.

2.2.2 Radiant Heating Pumping and Control System:

Contractor shall furnish and install a panel mounted radiant heating system pumping and control package as indicated on the drawings. All control and subsequent radiant system equipment shall be furnished and installed on a custom-engineered panel. Packages shall meet characteristics as scheduled on the Equipment Schedule drawings.

Panel shall integrate the heat source with thermostatically controlled zones. Panel shall include as a minimum a supply loop and supply pumps, a temperature mixing loop with a variable speed pump for temperature control, and the appropriate number of both high temperature and low temperature zone loops as indicated on plans and installation drawings. Panel shall be designed based on a primary/secondary piping configuration with the primary loop being of a one-pipe primary design.

The panel shall include the following components:

a. loop pump with isolation valves and check valve, sized for the full panel flow and primary loop head requirement.

b. zone pumps with isolation valves and check valve, as shown, sized for the required zone flow and head of each zone.

c. a dedicated air separator with air vent as required.

d. low water cut-off device

e. automatic pressure-reducing fill valve with fast-fill bypass line.

f. a dedicated bladder type expansion tank.

g. control system capable of controlling all of the panel pumps, panel temperatures, and the heat source (when required).

h. temperature sensors installed to monitor the primary loop and the radiant loop temperatures. Sensors shall be installed, wired and insulated in the appropriate locations whether indicated or not.

i. Isolation valve required for both service isolation and start-up purging.

j. A wye strainer, temperature and pressure gauges, electrical junction box, and fused on-off switch are also standard components whether or not so indicated.

Control(s) system shall be capable of controlling the entire radiant system including zone control, supply water temperature reset, and set-point control. Control(s) shall be a 120Vac microprocessor-based control designed to control the scheduled number of zones. The controls shall operate the two water source heat pumps, variable speed pumps CP-4 & -5, additional zonal system pumps if so required, and a DHW control device. The control system shall come with sensors to provide loop and input, outdoor temperature sensor and enclosure for outdoor temperature feedback, and the scheduled number of 054 RTU sensor to provide temperature feedback from each zone.

Panel electrical components shall consist of an electrical service box to enclose all relays and transformers, pre-wired terminal strips for all electrical connections, "plug in" cube relays with socket bases, transformers, a fused on-off switch, and an electrical schematic showing board wiring logic, necessary electrical connections to free-standing equipment, and thermostats.

All panel components shall be hard mounted to a rigid backboard(s). The rigid backboard shall be covered and trimmed with polished aluminum.

Panel design and layout shall be as provided by local manufacturer's representatives, or the manufacturer.

2.2.3 Package Electric Connections:

The radiant pump and control packages shall be provided as a complete package. The contractor shall take responsibility for the installation and interconnections of the necessary devices. Components shall be installed as noted on plans and installation drawings, and shall include but not be limited to:

a. Outdoor Sensor - Sensor shall be mounted on an exterior north wall out of direct contact from the sun. Unit shall be either flush mounted or mounted onto a 2" x 4" electrical box. Connect 18 AWG wires to the sensor and run them back to the control panel. Refer to manufacturer's installation instructions for further details.

b. Room Thermostat Units (RTUs) - A sensor from each zone (or manifold) shall be mounted on an interior wall. Unit shall be flush mounted to the wall. Connect 18 AWG wires to the sensor and run them back to the control panel.

d. Electrical power to the package of the appropriate voltage and.

2. Sensor wires shall not be run in parallel with phone or electrical wires. If wires are located in an area of strong electromagnetic interference, shielded cable or twisted pairs should be used or the wires should be run in grounded metal conduit.

2.2.4 Package Incorporation with Temperature Control System:

To assist in system integration the radiant pump and control packages shall

be provided with a remote start/stop contact for external operation. Further interlocking functionality with the building DDC system shall be as indicated, or as specified in Section 15910.

PART 3 EXECUTION

3.1 GENERAL;

Contractor shall coordinate the entire radiant system installation with the system equipment provider. All components shall be installed in accordance with manufacturer's installation instructions.

Examine areas and conditions under which radiant equipment is to be installed; do not proceed with work until unsatisfactory conditions have been corrected to the satisfaction of the contracting officer's representative.

Radiant system shall be filled with a 40% Propylene Glycol mixture.

Provide adequate clearance around all manifolds and components for maintenance as recommended by the manufacturer.

Provide an adequate number of isolation valves for service and maintenance of the system and its components as recommended by the manufacturer.

Provide temperature and pressure gauges where and as detailed or directed.

Pumps shall have sufficient capacity to circulate the scheduled GPM against the scheduled external head (feet) with the horsepower and speed as scheduled. Pump characteristics shall be such that the head of the pump under varying conditions shall not exceed the rated horsepower of the drive motor. When pumping glycol corrections shall be made to pumping horsepower.

All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any loads or stresses being applied to the connections or piping. All piping shall be fitted to the equipment even though piping adjustments may be required after the pipe is installed.

Provide drains for relief valves and package drains. Relief valves shall be piped to and discharging into floor drains. Package drains need not be hard piped to drain, but shall have reasonable access to a floor drain for system drainage.

Manufacturer's representative shall instruct the maintenance personnel in the care of the equipment and six (6) copies of his report shall be submitted to Gov't.

Provide start-up reports outlining factory provided start-up and equipment performance.

3.2 INSTALLATION;

Radiant tubing shall be installed in the manner outlined on plans and

installation drawings, and per the manufacturer's recommended installation drawings. Provide suitable allowance for penetration of structural footings where indicated.

Radiant tubing shall be provided as precut units of set lengths; the lengths shall be based on the system design criteria. Each length of tubing shall be connected to the manifold set; each length of tubing connected to a given manifold set shall be of equal length. The provided tubing should not be cut in the field, unless an equal amount of tubing is removed from each tube connected to the manifold set.

Tubing shall be installed continuously throughout the entire radiant area. Tubing shall be installed at indicated spacing.

Tubing should be affixed to the fittings on the manifolds and held in place via tension clamps.

Upon completion of the tubing installation, contractor should pressure test the tubing system before filling the system with water/glycol or proceeding with covering of the tubing system. Each manifold set shall be isolated from the main system and the tubing connected to that manifold set shall be pressure tested under 100 PSI air pressure per manufacturer's recommended installation instructions. Test pressure shall be held for a minimum of 24 hours and a maximum of 72 hours. Any substantial loss of air pressure denotes a system leak that must be located and repaired. After system repair pressure test should be repeated.

After a successful pressure test the tubing system can be covered. When encapsulating tubing in concrete or working in proximity to the tubing the system should be placed under either water or air pressure. Working around the tubing with it under pressure will noticeably alert installers if the tubing has been damaged during construction. Construction around the tubing can then be stopped until the tubing is repaired. Pressurizing the system with air will create a less catastrophic effect if the tubing is damaged then water, but the duration that a system is under air pressure should be limited. Prolonged exposure to air pressure may allow some air to be absorbed into the inner tubing layer and cause start-up nuisances.

3.3 FIELD QUALITY CONTROL;

Flush and clean system piping upon completion of installation, in accordance with manufacturer's start-up instructions.

Hydrostatically test system including radiant tubing system, interconnecting piping, and pumping and control package.

Start-up system, in accordance with manufacturer's start-up instructions, and in presence of equipment manufacturer's representative. Test controls and demonstrate compliance with requirements (coordinate with work of Division 15 Section 15900. Temperature Controls).

3.4 CLOSEOUT PROCEDURE

Provide services of manufacturer's technical representative for two 8-hour

days to instruct personnel in operation and maintenance of the heating circuits and the controls.

Schedule training with Gov't, provide at least 21-day notice to Contractor and Engineer of training date.

-- End of Section --

SECTION 15760

UNITARY HEATING UNITS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures
NEMA MG 1	(2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2003) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	(2002) National Fuel Gas Code
NFPA 70	(2005) National Electrical Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2002) Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	(1999) Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Unit heaters

Infrared heaters

SD-10 Operation and Maintenance Data

Unit heaters, Data Package 2

Infrared heaters, Data Package 2

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Louvers may be substituted by discharge cones or diffusers. Provide thermostats as indicated. Furnish circuit breaker disconnect switch.

2.1.1 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated. Provide control-circuit terminals and single source of power supply. Heater 5 Kw and larger shall be three-phase, with load balanced on each of the three phases. Limit leaving air temperature below 60 degrees C at 15.5 degrees C entering air.

2.1.1.1 Casing

Minimum 21 gage steel.

2.1.1.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 288 degrees C at any point during normal operation.

2.1.1.3 Controls

Include limit controls for thermal overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide room thermostat for pilot duty.

2.1.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 60 degrees C copper wiring.

2.2 FAN

Provide fans with ball or roller bearings for motors over 0.09 kW and sleeve bearings for motors 0.09 kW and under. Provide sleeve bearings with oil reservoir, if not permanently lubricated.

2.3 MOTOR AND STARTER

NEMA MG 1, and NEMA ICS 2, and NEMA ICS 6, respectively. Provide continuous-duty motor with built-in automatic reset thermal overload protection. For motor 0.37 kW and larger, use three-phase. Provide single-phase motor of permanent split capacitor or capacitor start. Limit motor speed at 1800 rpm. Wire motor to heater power supply source.

2.4 NOISE, VIBRATION AND SEISMIC CONTROLS

Section 15070 MECHANICAL SOUND VIBRATION AND SEISMIC CONTROL.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators. Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Vents

NFPA 54 and NFPA 211. Provide vents with weatherproofing flashings in accordance with Section 07600 FLASHING AND SHEET METAL.

3.1.3 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

3.2.3 Field Tests

3.2.3.1 Operational Tests

Operate equipment continuously under varying load conditions to verify functioning of combustion controls, electrical controls, flame safeguard controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

-- End of Section --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
ARI 350	(2000) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 410	(2001; Addendum 2002) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1999) Central-Station Air-Handling Units
ARI 440	(1998) Room Fan-Coils
ARI 880	(1998) Air Terminals
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

ACCA Manual 4	(2001) Installation Techniques for Perimeter Heating & Cooling; 11th Edition

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(1996) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

ABMA 11	(1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM C 916	(1985; R 1996el) Adhesives for Duct Thermal Insulation
ASTM C 1071	(2000) Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM D 520	(2000) Zinc Dust Pigment
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power in a Duct
ASHRAE 70	(1991) Method of Testing for Rating the Performance of Air Outlets and Inlets

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1419	(Rev D; Canc. Notice 1) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Install Fire Damp HVAC	(1992; 2th Printing 1996) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

UNDERWRITERS LABORATORIES (UL)

UL 94	(1996; Rev thru Dec 2003) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 181	(1996; Rev thru Dec 1998) Factory-Made Air Ducts and Air Connectors
UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
UL 555	(1999; Rev thru Jan 2002) Fire Dampers
UL 723	(2003) Test for Surface Burning Characteristics of Building Materials
UL 900	(1994; Rev thru Oct 1999) Air Filter Units
UL 1995	(1995; Rev thru Aug 1999) Heating and Cooling Equipment
UL Bld Mat Dir	(2003) Building Materials Directory
UL Elec Const Dir	(2003) Electrical Construction Equipment

Directory

UL Fire Resist Dir (2004) Fire Resistance Directory

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings
Installation

Drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment

Manufacturer's catalog data included with the detail drawings

for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

a. Piping Components

b. Ductwork Components

c. Air Systems Equipment

d. Air Handling Units

e. Energy Recovery Devices

f. Terminal Units

Test Procedures

Proposed test procedures for piping hydrostatic test and performance tests of systems, at least 2 weeks prior to the start of related testing.

Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Manufacturer's Experience

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Performance Tests

Proposed test schedules for hydrostatic test of piping and performance tests, at least 2 weeks prior to the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests
Testing, Adjusting, and Balancing

Test reports for the piping hydrostatic test and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-07 Certificates

Bolts

Written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, and the number of each type of bolt to be furnished.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year manufacturer's experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate installed by the manufacturer that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed according to Section 05500 MISCELLANEOUS METAL.

2.5 PIPING COMPONENTS

2.5.1 Steel Pipe

Steel pipe shall conform to ASTM A 53/A 53M, Schedule 40, Grade A or B, Type E or S.

2.5.2 Joints and Fittings For Steel Pipe

Joints shall be welded, flanged, threaded, or grooved as indicated. If not otherwise indicated, piping 1 inch and smaller shall be threaded; piping larger than 1 inch and smaller than 3 inches shall be either threaded, grooved, or welded; and piping 3 inches and larger shall be grooved, welded, or flanged. Rigid grooved mechanical joints and fittings may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 230 degrees F. Flexible grooved joints shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein. The manufacturer of each fitting shall be permanently identified on the body of the fitting according to MSS SP-25.

2.5.2.1 Welded Joints and Fittings

Welded fittings shall conform to ASTM A 234/A 234M, and shall be identified with the appropriate grade and marking symbol. Butt-welded fittings shall conform to ASME B16.9. Socket-welded fittings shall conform to ASME B16.11.

2.5.2.2 Flanged Joints and Fittings

Flanges shall conform to ASTM A 181/A 181M and ASME B16.5, Class 150. Gaskets shall be nonasbestos compressed material according to ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns

shall conform to ASME B16.5. Bolts shall be high or intermediate strength material conforming to ASTM A 193/A 193M.

2.5.2.3 Threaded Joints and Fittings

Threads shall conform to ASME B1.20.1. Unions shall conform to ASME B16.39, Class 150. Nipples shall conform to ASTM A 733. Malleable iron fittings shall conform to ASME B16.3, type as required to match piping.

2.5.2.4 Dielectric Waterways

Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.5.2.5 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12; or steel conforming to ASTM A 106, Grade B or ASTM A 53/A 53M. Gaskets shall be molded synthetic rubber with central cavity, pressure responsive configuration and shall conform to ASTM D 2000 Grade No. 2CA615A15B44F17Z for circulating medium up to 230 degrees F or Grade No. M3BA610A15B44Z for circulating medium up to 200 degrees F. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts shall be steel and shall conform to ASTM A 183.

2.5.3 Copper Tube

Copper tube shall conform to ASTM B 88, and ASTM B 88M, Type K or L.

2.5.4 Joints and Fittings For Copper Tube

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 230 degrees F. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.5.5 Valves

Valves shall be Class 125 and shall be suitable for the intended application. Valves shall meet the material, fabrication and operating requirements of ASME B31.1. Chain operators shall be provided for valves located 10 feet or higher above the floor. Valves in sizes larger than 1 inch and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves shall be subject to the same requirements as rigid grooved mechanical joints and fittings and, shall be provided by the same manufacturer as the grooved pipe joint and fitting system.

2.5.5.1 Gate Valves

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with rising stem and threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 and shall be cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.5.5.2 Globe Valves

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85 and shall be cast iron with bronze trim and flanged, or threaded ends.

2.5.5.3 Check Valves

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71 and shall be cast iron with bronze trim and flanged or threaded ends.

2.5.5.4 Angle Valves

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 and shall be bronze with threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85 and shall be cast iron with bronze trim and flanged, or threaded ends.

2.5.5.5 Ball Valves

Ball valves 1/2 inch and larger shall be ductile iron or bronze with threaded, soldered, or flanged ends.

2.5.5.6 Butterfly Valves

Butterfly valves shall be 2 flange or lug wafer type, and shall be bubble-tight at 150 psig. Valve bodies shall be cast iron, malleable iron, or steel ASTM A 167, Type 404 or Type 316, corrosion resisting steel stems, bronze or corrosion resisting steel discs, and synthetic rubber seats shall be provided. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance

return stops and position indicators. Valves in insulated lines shall have extended neck to accommodate insulation thickness.

2.5.5.7 Balancing Valves

Balancing valves 2 inches or smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valves 1 inch or larger may be all iron with threaded or flanged ends. The valves shall have a square head or similar device and an indicator arc and shall be designed for 250 degrees F. Iron valves shall be lubricated, nonlubricated, or tetrafluoroethylene resin-coated plug valves. In lieu of plug valves, ball valves may be used. Plug valves and ball valves 8 inches or larger shall be provided with manual gear operators with position indicators. Where indicated, automatic flow control valves may be provided to maintain constant flow, and shall be designed to be sensitive to pressure differential across the valve to provide the required opening. Valves shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Valves shall control the flow within 5 percent of the tag rating. Valves shall be suitable for the maximum operating pressure of 125 psig or 150 percent of the system operating pressure, whichever is the greater. Where the available system pressure is not adequate to provide the minimum pressure differential that still allows flow control, the system pump head capability shall be appropriately increased. Where flow readings are provided by remote or portable meters, valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential across the automatic flow control valve. A portable meter furnished with accessory kit as recommended by the automatic valve manufacturer shall be provided. Automatic flow control valve specified may be substituted for venturi tubes or orifice plate flow measuring devices.

2.5.5.8 Air Vents

Manual air vents shall be brass or bronze valves or cocks suitable for pressure rating of piping system and furnished with threaded plugs or caps. Automatic air vents shall be float type, cast iron, stainless steel, or forged steel construction, suitable for pressure rating of piping system.

2.5.6 Strainers

Strainer shall be in accordance with ASTM F 1199 or ASTM F 1200, except as modified herein. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. The strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with removable cover and sediment screen. The screen shall be made of minimum 22 gauge corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.3 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.5.7 Water or Steam Heating System Accessories

Water or steam heating accessories such as expansion tanks and steam traps shall be as specified in Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH.

2.5.8 Glycol

The glycol shall be tested according to ASTM D 1384 and shall cause less than 0.5 mils penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicon based inhibitors shall not be used. The solution shall be compatible with all wetted items within the system.

2.5.9 Backflow Preventers

Backflow preventers shall be according to Section 15400 PLUMBING, GENERAL PURPOSE.

2.5.10 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service as appropriate for the static head plus the system head, and 250 degrees F, for grooved end flexible connectors. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. The flexible section shall be suitable for intended service with end connections to match adjacent piping. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.5.11 Pressure Gauges

Gauges shall conform to ASME B40.100 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 3-1/2 inches in diameter and shall have a range from 0 psig to approximately 1.5 times the maximum system working pressure.

2.5.12 Thermometers

Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale, and shall have rigid stems with straight, angular, or inclined pattern.

2.5.13 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or setscrews.

2.5.14 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.5.15 Expansion Joints

2.5.15.1 Slip Joints

Expansion joints shall provide for either single or double slip of the connected pipes, as required or indicated, and for not less than the traverse indicated. The joints shall be designed for working temperature and pressure suitable for the application, but not less than 150 psig, and shall be according to applicable requirements of EJMA Stds and ASME B31.1. End connections shall be flanged or beveled for welding as indicated. Joint shall be provided with an anchor base where required or indicated. Where adjoining pipe is carbon steel, the sliding slip shall be seamless steel plated with a minimum of 2 mils of hard chrome according to ASTM B 650. All joint components shall be suitable for the intended service. Initial setting shall be made according to the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer, but in any case shall be not more than 4 inches or smaller, guides shall be installed not more than 2 feet from the joint. Service outlets shall be provided where indicated.

2.5.15.2 Flexible Ball Joints

Flexible ball joints shall conform to EJMA Stds and ASME B31.1 and be constructed of alloys as appropriate for the service intended. Where so indicated, the ball joint shall be designed for packing injection under full line pressure to contain leakage. The joint ends shall be threaded to 2 inches only, grooved, flanged, or beveled for welding as indicated or required and shall be capable of absorbing a minimum of 15-degree angular flex and 360 degree rotation. Balls and sockets shall be suitable for the intended service. The exterior spherical surface of carbon steel balls shall be plated with mils of hard chrome according to ASTM B 650. The ball type joints shall be designed and constructed according to EJMA Stds and ASME B31.1 where applicable. Where required, flanges shall conform to ASME B16.5.

2.5.15.3 Bellows Type Joints

Bellows type joints shall be flexible, guided expansion joints. The expansion element shall be stabilized corrosion resistant steel. Bellows type expansion joints shall conform to the applicable requirements of EJMA Stds with internal sleeves. Guiding of piping on both sides of expansion joint shall be according to the published recommendations of the manufacturer of the expansion joint. The joints shall be designed for the working temperature and pressure suitable for the application but not less than 150 psig.

2.5.16 Insulation

Shop and field applied insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.5.17 Condensate Drain Lines

Condensate drainage shall be provided for each item of equipment that generates condensate as specified for drain, waste, and vent piping systems in Section 15400 PLUMBING, GENERAL PURPOSE.

2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 745 W and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 7.45 kW or less. Adjustable frequency drives shall be used for larger motors.

2.7 CONTROLS

Controls shall be provided as specified in Section 15910 DIRECT DIGITAL CONTROL (DDC)SYSTEMS.

2.8 DUCTWORK COMPONENTS

2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 125, 250, and 500 Pa (1/2, 1, and 2 inch w.g.) ductwork shall meet the requirements of Seal Class C. Class 750 through 2500 Pa (3 through 10 inch w.g.) shall meet the requirements of Seal Class A. All ductwork in VAV systems upstream of the VAV boxes shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS and shall be suitable for the range of air distribution and ambient temperatures that it will be exposed to. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive

screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 50 mm band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.8.1.2 Metallic Flexible Duct

Metallic type duct shall be single-ply galvanized steel, Type 316 stainless steel or two-ply aluminum, self supporting to 2.4 m spans. Duct shall be of corrugated/interlocked, folded and knurled type seam construction, bendable without damage through 180 degrees with a throat radius equal to 0.5 duct diameter. Duct shall conform to UL 181 and shall be rated for positive or negative working pressure of 3.75 kPa at 177 degrees C when duct is aluminum, and 343 degrees C when duct is galvanized steel or stainless steel.

2.8.1.3 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall in no case exceed 3 m. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.8.1.4 General Service Duct Connectors

A flexible duct connector approximately 150 mm in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall

be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.8.2 Ductwork Accessories

2.8.2.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 375 x 450 mm, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 600 x 600 mm or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.8.2.2 Fire Dampers

Fire dampers shall be 1.5 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. The Contractor shall perform the fire damper test as outlined in NFPA 90A. A pressure relief damper shall be provided upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then this pressure relief damper shall be factory insulated. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be constructed in conformance with UL Fire Resist Dir. Fire dampers shall be curtain type with damper blades out of the air stream or multi-blade type. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed. Acceptance testing of fire dampers shall be performed per paragraph Fire Damper Acceptance Test and NFPA 90A.

2.8.2.3 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges

rounded. Splitters shall be operated by quadrant operators or 5 mm rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 200 mm. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 300 mm. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.8.2.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.8.2.5 Electric Heating Coil

Coil shall be an electric duct heater in accordance with UL 1995 and NFPA 70. Coil shall be duct- or unit-mounted. Coil shall be of the nickel chromium resistor, single stage, strip or stainless steel, fin tubular type. Coil shall be provided with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Coil casing and support brackets shall be of galvanized steel or aluminum. Coil shall be mounted to eliminate noise from expansion and contraction and be completely accessible for service. Where applicable, coil shall be designed to be installed in interior insulated ducts.

2.8.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.8.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 375 mm in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 375 mm in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 1.0 mm galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 25 mm clearance between the duct and the sleeve or 25 mm clearance between the insulation and the sleeve for insulated ducts.

2.8.3.2 Framed Prepared Openings

Openings shall have 25 mm clearance between the duct and the opening or 25 mm clearance between the insulation and the opening for insulated ducts.

2.8.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 100 mm wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 375 mm in diameter or less shall be fabricated from 1.0 mm galvanized steel. Collars for round ducts larger than 375 mm and square, and rectangular ducts shall be fabricated from 1.3 mm galvanized steel. Collars shall be installed with fasteners on maximum 150 mm centers, except that not less than 4 fasteners shall be used.

2.8.4 Plenums and Casings for Field-Fabricated Units

2.8.4.1 Plenum and Casings

Plenums and casings shall be fabricated and erected as shown in SMACNA HVAC Duct Const Stds, as applicable. Unless otherwise indicated, system casing shall be constructed of not less than 1.6 mm (16 gauge) galvanized sheet steel. Cooling coil drain pans with 25 mm threaded outlet shall be provided to collect condensation from the cooling coils. Drain pans shall be fabricated of not lighter than 1.6 mm steel, galvanized after fabrication or of 1.3 mm corrosion-resisting sheet steel conforming to ASTM A 167, Type 304, welded and stiffened. Drain pans exposed to the atmosphere shall be thermally insulated to prevent condensation. Insulation shall be coated with a flame resistant waterproofing material.

Separate drain pans shall be provided for each vertical coil section, and a separate drain line shall be provided for each pan. Pans shall be generously sized to ensure capture of entrained moisture on the downstream-air side of the coil. Openings in the casing, such as for piping connections, shall be sealed and covered to prevent air leakage. Water seal for the drain shall provide at least 500 Pa greater than the maximum negative pressure in the coil space.

2.8.4.2 Casing

Casings shall be terminated at the curb line and anchored by the use of galvanized angle iron sealed and bolted to the curb, as indicated in SMACNA HVAC Duct Const Stds.

2.8.4.3 Access Doors

Access doors shall be provided in each section of the casing. Door frames shall be welded in place, and each door shall be neoprene gasketed, hinged with minimum of two brass hinges, and fastened with a minimum of two brass tension fasteners operable from inside and outside of the casing. Where possible, doors shall be 900 x 450 mm located 450 mm above the floor. Where the space available will not accommodate doors of this size, doors as large as the space will accommodate shall be provided. Doors shall swing so that fan suction or pressure holds door in closed position, and shall be airtight. A push-button station to stop the supply fan shall be located inside the casing where indicated.

2.8.4.4 Factory-Fabricated Insulated Sheet Metal Panels

Factory-fabricated components may be used for field-assembled units, provided all requirements specified for field-fabricated plenums and casings are met. Panels shall be of modular design, pretested for structural strength, thermal control, condensation control, and acoustical control. Panel joints shall be sealed and insulated. Access doors shall be provided and gasketed to prevent air leakage. Panel construction shall be not less than 1.0 mm galvanized sheet steel and shall be assembled with fasteners treated against corrosion. Standard length panels shall deflect not more than 13 mm under operation. Details of construction, including joint sealing, not specifically covered shall be as indicated in SMACNA HVAC Duct Const Stds. The plenums and casings shall be constructed to withstand the specified internal pressure of the air systems.

2.8.4.5 Duct Liner

Unless otherwise specified, duct liner shall conform to ASTM C 1071, Type I or II.

2.8.5 Sound Attenuation Equipment

a. Systems With Total Pressure Above 0.75 kPa:

Sound attenuators shall be provided on the discharge duct of each fan operating at a total pressure above 0.75 kPa, and, when indicated, at the intake of each fan system. Sound attenuators shall be provided elsewhere

as indicated. The sound attenuators shall be factory fabricated and shall be tested by an independent laboratory for sound and performance characteristics. Net sound reduction shall be as indicated. Maximum permissible pressure drop shall not exceed 157 Pa. Traps shall be constructed to be airtight when operating under an internal static pressure of 2.5 kPa. Air-side surface shall be capable of withstanding air velocity of 50 m/s (10,000 fpm). The Contractor shall certify that the sound reduction values specified will be obtained after the equipment is installed in the system and coordinated with the sound information of the system fan to be provided. Sound absorbing material shall conform to ASTM C 1071, Type I or II. Sound absorbing material shall meet the fire hazard rating requirements for insulation specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. A duct transition section shall be provided for connection to ductwork. Factory fabricated double-walled internally insulated spiral lock seam and round duct and fittings designed for high pressure air system may be provided in lieu of factory fabricated sound attenuators, and shall comply with requirements specified for factory fabricated sound attenuators. The double-walled duct and fittings shall be constructed of an outer metal pressure shell of zinc-coated steel sheet, 25 mm thick acoustical blanket insulation, and an internal perforated zinc-coated metal liner. Sufficient length of run shall be provided to obtain the noise reduction coefficient specified. The Contractor shall certify that the sound reduction value specified will be obtained within the length of duct run provided. The outer sheet metal of the double-walled duct shall have welded, or spiral lock, seams to prevent water vapor penetration. The outer sheet of the duct and fittings shall conform to the metal thickness of high pressure spiral and round ducts and fittings shown in SMACNA HVAC Duct Const Stds. The acoustical insulation shall have a thermal conductivity "k" of not more than 0.0389 W/m-K at 24 degrees C mean temperature. The internal perforated zinc-coated metal liner shall be not less than 0.7 mm with perforations not larger than 6.35 mm in diameter providing a net open area not less than 10 percent of the surface.

b. System With Total Pressure of 1000 Pa and Lower:

Sound attenuators shall be provided only where indicated, or in lieu of lined ducts. Factory fabricated sound attenuators shall be constructed of galvanized steel sheets. Outer casing shall be not less than 0.85 mm. Acoustical fill shall be fibrous glass. Net sound reduction shall be as indicated. Values shall be obtained on a test unit not less than 600 by 600 mm outside dimensions made by a certified nationally recognized independent acoustical laboratory. Air flow capacity shall be as indicated or required. Pressure drop through the attenuator shall not exceed the value indicated, or shall not be in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Sound attenuators shall be acoustically tested with metal duct inlet and outlet sections while under the rated air flow conditions. Noise reduction data shall include the effects of flanking paths and vibration transmission. Sound attenuators shall be constructed to be airtight when operating at the internal static pressure indicated or specified for the duct system, but in no case less than 500 Pa.

c. Acoustical Duct Liner:

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 25 mm thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the ductwork shall be the thermal equivalent of the insulation specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be the net size available after allowing for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of fibrous glass duct or factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory.

2.8.6 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 0.25 m/s in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 2 m above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.8.6.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors and/or induction vanes of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers, or as indicated.

2.8.6.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 150 mm below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 150 mm above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8.7 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 10201 METAL WALL LOUVERS.

2.8.8 Bird Screens and Frames

Bird screens and frames shall be as specified in Section 10201 METAL WALL LOUVERS.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Unless indicated otherwise, fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 11 kW and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.9.1.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or

indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved or backward-inclined airfoil design in wheel sizes up to 750 mm. Fan wheels 900 mm or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have open, dripproof or totally enclosed enclosures, as required. Motor starters shall be magnetic across-the-line type with general-purpose enclosure, unless the motors are powered by a variable frequency drive (VFD). Remote switch connected to a toilet light switch with time delay off shall be provided where indicated.

2.9.1.2 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts, if not direct drive. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Motors shall have open, dripproof or totally enclosed enclosure, as required. Motor starters shall be magnetic across-the-line with general-purpose enclosures, unless indicated otherwise. Remote manual switch with pilot indicating light shall be provided where indicated.

2.9.1.3 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

2.9.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.406 mm. Aluminum fins shall be 0.14 mm minimum thickness. Copper fins shall be 0.114 mm minimum thickness. Casing and tube support sheets shall be not lighter than 1.6 mm

(16 gauge) galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 2.76 MPa air pressure and shall be suitable for 1.38 MPa working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.9.2.1 Water Coils

Water coils shall be installed with a pitch of not less than 10 mm per meter of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.3 Air Filters

Air filters shall be listed according to requirements of UL 900.

2.9.3.1 Extended Surface Pleated Panel Filters

Filters shall be 50 mm depth, unless indicated otherwise, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 2.54 m/s shall not exceed 9 mm water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 Holding Frames

Frames shall be fabricated from not lighter than 1.6 mm sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints shall be airtight.

2.9.3.3 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 98 mm in diameter, shall have white dials with black figures, and shall be graduated in 0.0025 kPa mm (0.01 inch of water), and shall have a minimum range of 0.25 kPa (1 inch of water) beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure tips with integral compression fittings, two molded plastic vent valves, two 1.5 m minimum lengths of 6.35 mm diameter aluminum or vinyl tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Field-Fabricated Air Handling Units

Built-up units shall be as specified in paragraph DUCTWORK COMPONENTS. Fans, coils, and air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types indicated.

2.10.2 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type as indicated. Units shall include fans, coils, airtight insulated casing, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box or combination sectional filter-mixing box, vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.10.2.1 Casings

Casing sections shall be single wall type constructed of a minimum 1.3 mm galvanized steel, or 1.3 mm steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Casing shall be designed and constructed with an integral insulated structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 1.3 mm outer and 1.0 mm inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 300 mm wide by 300 mm high. Access doors shall be minimum 600 mm wide and shall be the full height of the unit casing or a minimum of 1800 mm, whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-wall insulated type constructed of 1.4 mm galvanized steel or stainless steel, pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. Drain pan shall be constructed so that the pan may be visually inspected easily including underneath the coil without removal of the coil and so that the pan may be physically cleaned completely and easily underneath the coil without removal of the coil. Casing insulation shall conform to NFPA 90A Single-wall casing sections handling conditioned air shall be insulated with not less than 25 mm thick, 24 kg per cubic meter coated fibrous glass material having a thermal conductivity not greater than 0.033 W/m- . Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Air handling unit casing insulation shall be uniform over the entire casing. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal

nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections. Additional inspection doors, access doors and access sections shall be provided where indicated.

2.10.2.2 Heating Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

2.10.2.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.2.4 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 20 kW and below and fixed pitch above 20 kW as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have open enclosures. Motor starters shall be magnetic across-the-line type with general-purpose enclosure, unless the motors are powered by a variable frequency drive (VFD). Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300, ASHRAE 68, or ARI 260.

2.10.2.5 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall

be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams. Where indicated, factory-mounted low leak dampers that both modulate and measure outdoor airflow shall be provided. Accuracy shall be +/-5 percent of actual flow down to 15 percent nominal flow. Maximum leakage shall be +/-1 percent of nominal airflow at 249 Pa.

2.10.2.6 Dampers

Dampers shall be as specified in paragraph CONTROLS.

2.11 TERMINAL UNITS

2.11.1 Room Fan-Coil Units

Base units shall include galvanized coil casing, coil assembly drain pan, valve and piping package, air filter, fans, motor, fan drive, and motor switch, plus an enclosure for cabinet models and casing for concealed models. Leveling devices integral with the unit shall be provided for vertical type units. Sound power levels shall be as indicated. Sound power level data or values for these units shall be obtained according to test procedures based on ARI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models will be acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Automatic valves and controls shall be provided as specified in paragraph CONTROLS. Each unit shall be fastened securely to the building structure. Capacity of the units shall be as indicated. Room fan-coil units shall be certified as complying with ARI 440, and shall meet the requirements of UL 1995.

2.11.1.1 Enclosures

Enclosures shall be fabricated of not lighter than 1.3 mm steel, reinforced and braced. Front panels of enclosures shall be removable and provided with 7 mm closed cell insulation or 13 mm thick dual density foil faced fibrous glass insulation. The exposed side shall be high density, erosion-proof material suitable for use in air streams with velocities up to 23 m/s. Discharge grille shall be of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant according to UL 94 and the material shall comply with the heat deflection criteria specified in UL 1995. Ferrous metal surfaces shall be galvanized or factory finished with corrosion resistant enamel. Access doors or removable panels shall be provided for piping and control compartments. Duct discharge collar shall be provided for concealed models. Enclosures shall have easy access for filter replacement.

2.11.1.2 Fans

Fans shall be galvanized steel or aluminum, multiblade, centrifugal type.

In lieu of metal, fans and scrolls may be non-metallic materials of suitably reinforced compounds. Fans shall be dynamically and statically balanced. Surfaces shall be smooth. Assemblies shall be accessible for maintenance. Disassembly and re-assembly shall be by means of mechanical fastening devices and not by epoxies or cements.

2.11.1.3 Coils

Coils shall be constructed of not less than 10 mm outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Coils shall be provided with not less than 12 mm outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Coils shall be tested hydrostatically at 2000 kPa or under water at 1700 kPa air pressure and suitable for 1400 kPa working pressure. Provisions shall be made for coil removal.

2.11.1.4 Drain Pans

Drain and drip pans shall be sized and located to collect all water condensed on and dripping from any item within the unit enclosure or casing. Condensate drain pans shall be designed for self-drainage to preclude the buildup of microbial slime and shall be thermally insulated to prevent condensation and constructed of not lighter than 0.9 mm type 304 stainless steel or noncorrosive ABS plastic. Insulation shall have a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and shall be of a waterproof type or coated with a waterproofing material. Drain pans shall be pitched to drain and shall be designed so as to allow no standing water. Minimum 20 mm NPT or 15 mm OD drain connection shall be provided in drain pan. Auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages, may be plastic; if metal, the auxiliary pans shall comply with the requirements specified above. Insulation at control and piping connections thereto shall extend 25 mm minimum over the auxiliary drain pan.

2.11.1.5 Filters

Filters shall be of the fiberglass disposable type, 25 mm thick, conforming to CID A-A-1419. Filters in each unit shall be removable without the use of tools.

2.11.1.6 Motors

Motors shall be of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Motor switch shall be two or three speeds and off, manually operated, and shall be mounted on an identified plate inside the unit below or behind an access door or adjacent to the room thermostat. In lieu of the above fan speed control, a solid-state variable-speed controller having a minimum speed reduction of 50 percent may be provided. Motors shall have permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Motor power consumption, shown in watts, at the fan operating speed selected to meet

the specified capacity shall not exceed the following values:

Free Discharge Motors

Unit Capacity (L/S)	Maximum Power Consumption (Watts)		
	115V	230V	277V
94	70	110	90
142	100	110	110
189	170	150	150
283	180	210	220
378	240	240	230
472	310	250	270
566	440	400	440

High Static Motors

Unit Capacity (L/S)	Maximum Power Consumption (Watts)
94	145
142	145
189	210
283	320
378	320
472	530
566	530

2.11.2 Variable Air Volume (VAV) Terminal Units

VAV terminal units shall be the type, size, and capacity shown and shall be mounted in the ceiling or wall cavity and shall be suitable for single duct system applications. Actuators and controls shall be as specified in paragraph CONTROLS. Unit enclosures shall be constructed of galvanized steel not lighter than 0.85 mm or aluminum sheet not lighter than 1.3 mm. Single or multiple discharge outlets shall be provided as required. Units with flow limiters are not acceptable. Unit air volume shall be factory preset and readily field adjustable without special tools. A flow chart shall be attached to each unit. Acoustic performance of the terminal units shall be based upon units tested according to ARI 880. Sound power level shall be as indicated. Discharge sound power shall be shown for minimum and 375 Pa inlet static pressure. Acoustical lining shall be according to NFPA 90A.

2.11.2.1 Variable Volume, Single Duct

Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 200 to 1500 Pa. Internal resistance of units shall not exceed 100 Pa at maximum flow range. External differential pressure taps separate from the control pressure taps shall be provided for air flow measurement with a 0 to 250 Pa range.

2.11.2.2 Variable Volume, Single Duct, Fan-Powered

Variable volume, single duct, fan-powered terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, fan and motor, and accessory relays. Units shall control primary air volume to within plus or minus 5 percent of each air set point as determined by the thermostat with variations in inlet pressure from 200 to 1500 Pa. Unit fan shall be centrifugal, direct-driven, double-inlet type with forward curved blades. Fan motor shall be either single speed with speed controller or three-speed, permanently lubricated, permanent split-capacitor type. Fan/motor assembly shall be isolated from the casing to minimize vibration transmission. Fan control shall be factory furnished and wired into the unit control system. A factory-mounted pressure switch shall be furnished to operate the unit fan whenever pressure exists at the unit primary air inlet or when the control system fan operates.

2.11.2.3 Reheat Units

Hot Water Coils: Hot-water coils shall be fin-and-tube type constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Headers shall be constructed of cast iron, welded steel or copper. Casing and tube support sheets shall be 1.6 mm galvanized steel, formed to provide structural strength. Tubes shall be correctly circuited for proper water velocity without excessive pressure drop and they shall be drainable where required or indicated. At the factory, each coil shall be tested at not less than 1700 kPa air pressure and shall be suitable for 1400 kPa (200 psi) working pressure. Drainable coils shall be installed in the air handling units with a pitch of not less than 10 mm per m of tube length toward the drain end. Coils shall conform to the provisions of ARI 410.

2.11.3 Unit Ventilators

Unit ventilators shall include an enclosure, galvanized casing, coil assembly, valve and piping package, drain pan, air filters, fan assembly, fan drive, motor, motor controller, dampers, and damper operators. Sound power level shall be as indicated. Sound power level data or values for these units shall be obtained according to test procedures based on ARI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles, when handling standard flow for which the unit air capacity is rated. Each unit shall be secured to the building structure. Capacity of the unit ventilators shall be as indicated. Unit ventilators shall be of the year-round classroom type with automatic controls arranged to properly heat, cool, and ventilate the room. Automatic valves and controls shall be provided as specified in paragraph CONTROLS. Sequence of control shall be any one of the standard ANSI cycles specified in paragraph CONTROLS.

2.11.3.1 Enclosures

Enclosures shall be fabricated of not lighter than 1.6 mm (16 gauge) galvanized steel, reinforced and braced, or all welded framework with panels to provide equivalent strength. The casing shall be acoustically and thermally insulated internally with not less than 13 mm thick dual

density fibrous glass insulation. The exposed side shall be high density, erosion-proof material suitable for use in air streams with velocities up to 246 m/s. The insulation shall be fastened with waterproof, fire-resistant adhesive. Front panel shall be designed for easy removal by one person. Discharge grilles shall properly distribute air throughout the conditioned space. Return grilles shall be removable where front panel does not provide access to interior components. Plastic discharge or return grilles are not acceptable. Removable panels or access doors shall be provided for all piping and control compartments. Fan switch shall be key operated or accessible through a locked access panel. Gaskets shall be provided at the back and bottom of the unit for effective air seal, as required.

2.11.3.2 Fans

Fans shall be of the galvanized steel or aluminum, multiblade, centrifugal type, dynamically and statically balanced. Fan housings shall be provided with resilient mounted, self-aligning permanently lubricated ball bearings, sleeve bearings, or combination ball and sleeve bearings, capable of not less than 2000 hours of operation on one oiling. Fans shall be direct-connected.

2.11.3.3 Coils

Coils shall be circuited for a maximum water velocity of 2.4 m/s without excessive pressure drop and shall otherwise be as specified for hot water coils in paragraph TERMINAL UNITS.

2.11.3.4 Drain Pans

Drain and drip pans shall be sized and located to collect all condensed water dripping from any item within the unit enclosure. Drain pans shall be constructed of not lighter than 1.2 mm steel, galvanized after fabrication, and thermally insulated to prevent condensation. Insulation shall be coated with a fire-resistant waterproofing material. In lieu of the above, drain pans may be constructed of die-formed 1.0 mm steel, formed from a single sheet and galvanized after fabrication and insulated and coated as for the 1.3 mm steel material, or of die-formed 1.3 mm type 304 stainless steel insulated as specified above. Drain pans shall be pitched to drain. Drain connection shall be provided when a condensate drain system is indicated. Connection shall be minimum 20 mm NDT or 18 mm OD.

2.11.3.5 Filters

Fiberglass disposable type, 25 mm thick, conforming to CID A-A-1419, installed upstream of coil.

2.11.3.6 Dampers

An outside air proportioning damper shall be provided on each unit. In addition, a vane shall be provided to prevent excessive outside air from entering unit and to prevent blow-through of outside air through the return air grille under high wind pressures. Where outside air and recirculated air proportioning dampers are provided on the unit, an additional vane will

not be required. Face and bypass dampers shall be provided for each unit to ensure constant air volume at all positions of the dampers. Each unit shall be provided with a factory installed control cam assembly, electric motor to operate the face and bypass dampers and outside air damper or outside air and recirculated air dampers in the sequence as specified in paragraph CONTROLS.

2.11.3.7 Motors

Motors shall be of the permanent split-capacitor type with built-in thermal overload protection and automatic reset. Motor shall be mounted on a resilient mounting, isolated from the casing and shall be suitable for operation on electric service available. A manually operated motor switch shall provide for 2 or 3 speeds and off and shall be mounted on an identified plate inside the unit below or behind an access door or adjacent to the room thermostat. In lieu of speed control, a solid state variable speed controller having minimum speed reduction of 50 percent may be provided.

2.11.3.8 Outside Air Intakes

Outside air intakes shall be the manufacturer's standard design and provided with 13 mm mesh bird screen or louvers on 13 mm centers.

2.12 ENERGY RECOVERY DEVICES

2.12.1 Air-to-Air Plate Heat Exchanger

. Energy recovery unit shall be factory-fabricated for indoor installation, consisting of a flat plate cross-flow heat exchanger. Casing shall be 1 mm G90, galvanized steel, double wall construction with 50 mm insulation. (Heat exchanger core shall be fibrous desiccant cross-flow type capable of easy removal from the unit (keep this?)). Provide Frost Damper. Provide stainless steel IAQ drain pans with condensate line connections. Heat recovery regulation shall be provided by center exhaust air bypass. Provide factory mounted and field wired control end devices.

2.13 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 924/A 924M shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatized and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 3 mm. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Piping

Piping shall be installed as specified in Section 15556 FORCED HOT WATER HEATING SYSTEMS USING WATER TO WATER HEAT EXCHANGERS.

3.1.2 Equipment and Installation

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 150 mm concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.3 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.4 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.5 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall

be packed as specified in Section 07920 JOINT SEALANTS.

3.1.6 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.6.1 Underground Ductwork

Underground ductwork shall be PVC plastisol coated galvanized steel with coating on interior and exterior surfaces and watertight joints. Ductwork shall be installed as indicated, according to ACCA Manual 4 and manufacturer's instructions. Maximum burial depth shall be 2 m.

3.1.7 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA HVAC Duct Const Stds. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA HVAC Duct Const Stds to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.1.8 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work.

Temporary protection shall remain in place until system is ready for startup.

3.1.9 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit

3.1.10 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.11 Power Roof Ventilator Mounting

Foamed 13 mm thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.12 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND IDENTIFICATION SYSTEMS

3.2.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number shall be installed on all valves and dampers. Tags shall be 35 mm minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.2.2 Finish Painting and Pipe Color Code Marking

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.2.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of components and equipment that are not visible from the

finished space and are accessible from the ceiling grid. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm diameter and secured to removable ceiling panels with fasteners. Each fastener shall be inserted into the ceiling panel so as to be concealed from view. The fasteners shall be manually removable without the use of tools and shall not separate from the ceiling panels when the panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall be approximately 1 m wide, 750 mm high, and 12 mm thick. The board shall be made of wood fiberboard and framed under glass or 1.6 mm transparent plastic cover. The color code symbols shall be approximately 20 mm in diameter and the related lettering in 12 mm high capital letters. The color code board shall be mounted in the mechanical or equipment room.

3.3 PIPING HYDROSTATIC TEST

After cleaning, water piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Leaks shall be repaired and piping retested until test is successful. No loss of pressure will be allowed. Leaks shall be repaired by re-welding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before covering or concealing.

3.4 DAMPER ACCEPTANCE TEST

All fire dampers and smoke dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.5 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.6 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 2 days for each system and shall demonstrate that the entire system is functioning

according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, and the ambient temperature and humidity in a shaded and weather protected area.

3.7 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Manual air vents shall be plugged or capped after the system has been vented. Inside of room fan-coil units, air terminal units, unit ventilators, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 24 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

3.9 INDOOR AIR QUALITY ASSURANCE

3.9.1 Initial Building Flush Out

Prior to any furniture being placed in the building, but after completion of all scheduled interior construction finishes (trim, carpeting, painting, etc. but not including minor finish work associated with punchlist checks) operate the building's HVAC systems on 100% outdoor air for a period of 14 days to completely flush the building's air. Systems shall operate 18 hours/day on 100% outdoor air, with thermostats set to maintain space temperatures between 15.5°C (60°F) and 26.7°C (80°F). Promptly change out all system filters after this flush out period, and reset all adjusted items for normal operation.

3.9.2 Final Building Flush Out

After all furniture has been installed (unpacked and located) or at another similar time (as determined by the Owner), operate the building's HVAC systems on 100% outdoor air for an additional period of 14 days. Systems shall operate at least 18 hours/day on 100% outdoor air, with thermostats set to maintain space temperatures between 15.5°C and 26.7°C. Promptly change out all system filters after this flush out period, and reset all adjusted items for normal operation.

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SECTION 15910

DIRECT DIGITAL CONTROL (DDC) SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL(AMCA)

AMCA 500-D	(1998) Laboratory Methods of Testing Dampers for Rating

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/EIA 709.1B	(2002) Control Network Protocol Specification

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Fundamentals Handbook	(2001) Handbook, Fundamentals
ASHRAE Gdln3	(1998) Reducing Emission of Fully Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems
ASHRAE 135	(2001) BACnet®-A Data Communication Protocol for Building Automation and Control Networks

ASME INTERNATIONAL (ASME)

ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.1	(2001) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 126	(1995; R 2001) Gray Iron Castings for Valves, Flanges, and Pipe Fittings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.45	(1992) Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA HVACTAB	(2002) HVAC Systems Testing, Adjusting and Balancing

UNDERWRITERS LABORATORIES (UL)

UL 268A	(1998) Smoke Detectors for Duct Application
UL 506	(2000) Specialty Transformers
UL 916	(1998; Rev thru Nov 2001) Energy Management Equipment
UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors

1.2 DEFINITIONS

1.2.1 Digital Controller

1.2.1.1 Interoperable Digital Controller (IDC)

A control module which is microprocessor based Interoperable LonMark (TM) or LonWorks. HVAC control is accomplished using LonMark (TM) based devices where the application has a LonMark (TM) profile defined and performs stand-alone operations.

1.2.1.2 Interoperable BACnet Controller (IBC)

A control module which is microprocessor based Interoperable BACnet Controller in accordance with ASHRAE 135. IBC's must be provided with product interoperability compliance statement documents that demonstrate the compliance level to ASHRAE 135.

1.2.2 Direct Digital Control (DDC)

Digital controls, as defined in this specification, performing control logic. The controller directly senses building environment and makes control decisions based on user defined, controller resident programs. The controller outputs control signals that directly operate valves, dampers, and motor controllers. No conventional control devices, such as thermostats, and logic units are present within or interface with a direct digital control loop. Actuators are electric.

1.2.3 DDC System

A system made up of one or more interoperable digital controllers which communicate on a network.

1.2.4 Distributed Control

The intent of distributed control is to install the controllers near their respective controlled equipment. The control system consists of stand-alone controllers, with the total number of input and output points limited to 48 or less per controller. Failure of any single controller will not cause the loss of more then 48 control points.

1.2.5 Dynamic Control

A process that optimizes energy efficiency of HVAC systems (air handling units, converters, chillers, and boilers) by increasing and decreasing setpoints or starting and stopping equipment in response to heating and cooling needs of the facility. A requirement of dynamic control is knowing the heating/cooling demand status of the process. Therefore dynamic control requires controllers connected in a communications network and receiving feedback, necessary variable point data and/or actual status input to accomplish closed loop control.

1.2.6 Firmware

Firmware is software programmed into read only memory (ROM) and erasable programmable read only memory (EPROM) chips. Software may not be changed without physically altering the chip.

1.2.7 Graphic User Interface Software (GUI)

Graphic user interface software shall run on Microsoft Windows XP service Pack 2, or later. The GUI employs browser like functionality that includes a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. Pull down menus and toolbars employ buttons, commands and navigation that permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object definition.

1.2.8 Hand-Held Terminal

A hand-held terminal is a manufacturer specific device connected directly to a communications port on a controller, through which the controller is accessed and, in some cases, programmed. This style of interface is not an acceptable installation on Fort Lewis.

1.2.9 Input/Output (I/O) Points

I/O points refer to analog inputs (AI), digital inputs (DI), analog outputs (AO), and digital outputs (DO) in a digital controller. Another term for digital inputs and outputs is binary inputs and outputs. Inputs are from analog sensors (temperature, pressure, humidity, flow) and digital sensors (motor status, flow switches, switch position, and pulse output devices). Outputs operate modulating and on/off control devices.

1.2.10 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller and communicates with the stand-alone digital controller on a LAN. An I/O unit is not stand-alone because the control program does not reside in the I/O unit. An I/O expander which connects directly to a stand alone controller through a multi-line microprocessor bus is restricted to reside within 3 feet of the stand alone controller and is considered part of the stand alone controller. The total point count of the I/O and all connected expansion units shall not exceed the 48 point limit.

1.2.11 JACE (Java Application Control Engine) Network Area Controller (NAC)

The JACE network area controller (NAC) provides the interface between a higher level LAN or WAN and the interoperable digital controllers, providing global supervisory control functions. NAC's provide multiple user access at varying levels through password protection.

1.2.12 Local Area Network (LAN)

a. A communications bus that interconnects digital controllers for peer-to-peer (see "peer-to-peer" below) communications. Different levels of LANs are possible within a single DDC system. In this case, a digital controller on a higher level LAN acts as a network controller to the controllers on the lower level LAN. The network controller, then, has at least two LAN communications ports. One port supports peer-to-peer communications with other digital controllers on the higher level LAN. The other port supports communications with the digital controllers on the lower level LAN.

b. LANs permit sharing global information. This allows building and site wide control strategies such as peak demand limiting, dynamic control strategies, coordinated response to alarm conditions, and remote monitoring and programming of digital controllers.

c. The controllers peer-to-per communications bus is commonly referred to as "the field bus".

d. The "LAN" typically refers to the communications bus using the Ethernet protocols (Category 6) within a building.

1.2.13 LonMark

See LonMark International. Also, a certification issued by LonMark International to ANSI/EIA 709.1B devices.

1.2.14 LonMark International

Standards committee consisting of numerous independent product developers and systems integrators dedicated to determining and maintaining the interoperability guidelines for the LonWorks industry. Maintains guidelines for the interoperability of ANSI/EIA 709.1B devices and issues the LonMark Certification for ANSI/EIA 709.1B devices.

1.2.15 LonWorks

The overall communications technology, developed by Echelon Corporation, for control systems. The term is often used to refer to the technology in general, and may include reference to any/all of the: protocol, network management, and interoperability guidelines where the technology is based on the ANSI/EIA 709.1B protocol and employs interoperable devices along with the capability to openly manage these devices (via multiple vendors) using a network configuration (or service) tool.

1.2.16 Microprocessor

A microprocessor refers to the central processing unit (CPU) that contains all registers and logic circuitry that allow digital controllers to function.

1.2.17 Optimum Start

Optimum start is a method of starting HVAC equipment prior to scheduled occupancy in order to have the building at setpoint when occupied. Optimum start is based on the zone temperatures, zone setpoints, and outdoor temperature.

1.2.18 Peer-to-Peer

Peer-to-peer refers to controllers connected on a communications LAN typically referred to as the "field bus" that act independently, as equals, and communicate with each other to pass information.

1.2.19 Performance Verification Test

The performance verification test (PVT) is the formal commissioning of the DDC system performed after successful contractor field testing and prior to the second phase of DDC training. It is used as a means for final acceptance of the control system and provides a means to verify the system functions are performing IAW (in accordance with) the manufacturers written instructions, sequence of operation and control drawings.

1.2.20 PID

PID refers to proportional, integral, and derivative control; the three types of action that are used in controlling modulating equipment.

1.2.21 Resolution

Refers to the number of possible states an input value or output value can take and is a function of the digital controller I/O circuitry; the A/D converter for input and the D/A converter for output. Ten bit resolution has 1024 possible states.

1.2.22 Stand-Alone Control

Refers to the digital controller performing required climate control, and energy management functions without connection to another digital controller or computer. Requirements for stand-alone control are a time clock, a microprocessor, resident control programs, PID control, and I/O. All stand-alone controllers have a communication port and firmware for direct connection and interrogation with a laptop computer. This interrogation includes parameter changes and program downloads.

1.2.23 Terminal Control Unit (TCU)

An off-the-shelf, stand-alone digital controller equipped for communication on a lower level LAN. TCUs may deviate from stand-alone only in receiving energy management and time information from a stand alone digital controller. All TCU Units shall be remotely programmable or configurable using a Java Desktop Environment (JDE) engineering software package running on a Niagara Java Platform via the Ft. Lewis WAN (Wide Area Network) through the Tridium JACE (NAC). A TCU is commonly application specific and is used for distributed control of specific HVAC subsystems. A TCU communicates with other digital controllers. Typically, a TCU communicates on a lower level LAN. Examples where TCUs are used include small air handling units (AHUs), variable air volume (VAV) boxes, fan coil units, and heat pumps. TCUs shall be LonMark/LonWorks or BACnet-based. All TCUs shall be remotely programmable via the Fort Lewis WAN (Wide Area Network).

1.3 TEMPERATURE CONTROL AND FACILITY MANAGEMENT AND CONTROL SYSTEM

The entire Temperature Control System (TCS) shall be an extension of the existing Fort Lewis Niagara Framework Utilities Management and Control System (UMCS), comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/LonTalk and/or BACnet communication protocols to a JACE Network Area Controller (NAC).

The NAC shall connect to the owner's local or wide area network, depending on configuration and project requirements. Access to the system, either locally in each building, or remotely from a central site or sites as specified by Fort Lewis Public Works, shall be accomplished through standard Web browsers and/or local area network (LAN), and/or wide area network (WAN).

The UMCS shall be comprised of a network of interoperable, stand-alone digital controllers communicating to a host computer within one facility within the project using graphical user interface software and communicating via the Public Works "Environmental" V-LAN intranet and connecting to the Fort Lewis Master Web Supervisor host computer in a remote location over the Fort Lewis Wide Area Network (WAN). The UMCS shall communicate to third party systems such as chillers, boilers, air handling systems, energy metering systems, other energy management systems, access control systems, fire-life safety systems and other building management related devices with open, interoperable communication capabilities.

Provide a TCS and UMCS including associated equipment and accessories as specified. Manufacturer's products, including design, materials, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.1 and NFPA 70, except as modified herein or indicated otherwise.

The TCS systems shall maintain stable temperature control and all other conditions as indicated. The end-to-end accuracy of the system, including temperature sensor error, wiring error, A/D conversion, and display, shall be 0.5 degree C (1 degree F) or less.

1.4 DDC SYSTEM DESCRIPTION

1.4.1 Design Requirements

1.4.1.1 Control System Schematic

Provide control system schematic that includes the following:

a. Location of each input and output device

b. Flow diagram of each HVAC component, for instance flow through coils, fans, dampers

c. Name or symbol for each component such as V-1, DM-2, and T-1 for a valve, damper motor, and temperature sensor, respectively

d. Setpoints

e. Sensor range

f. Actuator range

g. Valve and damper schedules and normal position

h. Switch points on input switches

i. Written sequence of operation for each schematic

j. Schedule identifying each sensor and controlled device with the following information:

(1) LAN and Software point name with send and receive address if applicable

(2) Point type (AO, AI, DO, DI)

(3) Point range

(4) Digital controller number for each point

1.4.1.2 Electrical Equipment Ladder Diagrams

Submit diagrams showing electrical equipment interlocks, including voltages and currents.

1.4.1.3 Component Wiring Diagrams

Submit a wiring diagram for each type of input device and each type of output device. Diagram shall show how the device is wired and powered; showing typical connections at the digital controller and each power supply, as well as at the device itself. Show for all field connected devices, including, but not limited to, control relays, motor starters, electric or electronic actuators, and temperature, pressure, flow, proof, and humidity sensors and transmitters.

1.4.1.4 Terminal Strip Layout

Submit a diagram of each terminal strip, including digital controller base terminal strips (digital controllers shall not be directly wired for ease of removal and replacement), terminal strip location, termination numbers and the associated point names.

1.4.1.5 Communication Architecture Schematic

Submit a schematic showing communication networks used for all DDC system controllers, workstations, and field interface devices. Schematic shall show hierarchical topology. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server/computer using a Web Supervisor for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable. All controllers shall be fully programmable and/or configurable from a remote workstation via the WAN using a JDE (Java Desktop Environment) application and/or a Web Supervisor. Configurable controls are only acceptable in application specific topology i.e. VAV controllers part of a distributed control network connected to a higher level controller such as a Air Handling Unit controller.

1.4.1.6 Vendor Interoperability

The DDC network shall exchange point parameters listed in the Tables below with the heat pump controls. A parameter noted as a read point means that

the value is read at 1-minute minimum intervals by any relevant network controller to accomplish specified sequence of control. A parameter noted as a write point means the value is written at 1-minute minimum intervals by the controller network to the relevant equipment item to accomplish the pertinent sequence of control.

Point parameters read by the DDC network shall be available for analysis, trending, alarming, and other functions that are available for other similar parameters that are native to the DDC network. Any point scaling, unit conversion, or other manipulation necessary for correct program execution shall be programmed in the controller logic or communication gateway and transparent to the end user.

Exchange of information noted in the Tables below shall be over a single communication cable between communication ports on the equipment item, and the DDC network. A gateway or translator device is allowable between communication ports if necessary. The gateway and communication cable must meet all relevant criteria specified here-in.

All read and write point information listed in the Tables below shall be presented at their relevant locations in real time engineering units at the operator workstation.

Table (1) Shared Information between Heat Pump and Building DDC.
Note: Provide one set of parameters reflecting the Table below as a minimum, to each water-air heat pump in the building.

HP-

Point/Parameter	Units	Write to Heat Pump	Read by DDC
HP Enable	On/Off	X	
HP Supply Air Temperature Set Point	deg. F	X	
HP Supply Air Temperature	deg. F		X
HP Primary Bldg Loop Water Return Temperature	deg. F		X
HP Primary Bldg Loop Water Supply Temperature	deg. F		X
Motor Current	Amps		X
Accumulated Run Time	Hours		X

Table (2) Shared Information between Heat Pump and Building DDC.
Note: Provide one set of parameters reflecting the table below as a minimum, to each water-water heat pump in the building.

HP-

Point/Parameter	Units	Write to Heat Pump	Read by DDC
HP Enable	On/Off	X	
HP Load Side Water Supply Temperature Set Point	deg. F	X	
HP Load Side Water Supply Temperature	deg. F		X
HP Load Side Water Return Temperature	deg. F		X
HP Primary Bldg Loop Water Return Temperature	deg. F		X
HP Primary Bldg Loop Water Supply Temperature	deg. F		X
Motor Current	Amps		X
Accumulated Run Time	Hours		X

Table (3) Shared Information between Heat Exchanger and Building DDC. Note: Provide one set of parameters reflecting the table below as a minimum, to each heat exchanger in the building.

HX-

Point/Parameter	Units	Write to Heat Exch	Read by DDC
Entering Source Water Temperature	deg. F		X
Leaving Source Water Temperature	deg. F		X
Entering Load Water Temperature	deg. F		X
Leaving Load Water Temperature	deg. F		X

1.4.2 Symbols, Definition and Abbreviations

Symbols, definitions, and engineering unit abbreviations used in information displays, submittals and reports shall be as shown in the contract drawings. Symbols, definitions and abbreviations not in the contract drawings shall conform at a minimum to IEEE 100 and the ASHRAE

Fundamentals Handbook, unless indicated otherwise.

1.4.3 System Units and Accuracy

System print-outs and calculations shall be performed in English (inch-pound) units. Graphical user interface (GUI) system displays shall be in English (inch-pound) units. Parameter modifications made through the GUI shall be displayed and accomplished in English units. Calculations shall have accuracy equal to or exceeding sensor accuracy. Displays and printouts shall have precision and resolution equal to or exceeding sensor accuracy.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.

Submit manufacturers' specification sheets for each type of equipment to show compliance with the project specification. For each type of equipment highlight each compliance item and reference each item to the relevant specification paragraph number. Submit sufficient manufacturers' information to allow verification of compliance by the reviewing authority. Equipment and software for which specification compliance data shall be submitted (in accordance with Section 01330 SUBMITTAL PROCEDURES) includes but is not limited to the following:

SD-01 Preconstruction Submittals

List of Drawings; G

List of Symbols and Abbreviations Used on Drawings; G

List of I/O Points; G

Equipment Components List; G

AC Power Table; G

SD-02 Shop Drawings

Drawings shall be on A1 841 by 594 mm (34 by 22 inch) sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall have a unique identifier as shown. The HVAC Control System Drawings shall be delivered together as a complete submittal. Deviations must be approved by the Contracting Officer. Drawings shall be submitted along with Submittal SD-01, Preconstruction Submittals.

a. HVAC Control System Drawings shall include the following:

Sheet One: Drawing Index, HVAC Control System Legend.

Sheet Two: Valve Schedule, Damper Schedule.

Sheet Three: Deleted.

Sheet Four: Control System Schematic and Equipment Schedule.

Sheet Five: Sequence of Operation and Data Terminal Strip Layout.

Sheet Six: Control Loop Wiring Diagrams and Ladder Diagrams

Sheet Seven: Motor Starter and Relay Wiring Diagram.

Sheet Eight: Communication Network Architecture and Block Diagram; G.

Sheet Nine: DDC Panel Installation and Block Diagram.

b. The HVAC Control System Drawing Index shall show the name and number of the building and military site. The Drawing Index shall list HVAC Control System Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The HVAC Control System Legend shall show generic symbols and the name of devices shown on the HVAC Control System Drawings.

c. The valve schedule shall include each valve's unique identifier, size, flow coefficient Kv (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data. Valve schedules may be submitted in advance but shall be included in the complete submittal.

d. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the maximum leakage rate at the operating static-pressure differential. The Damper Schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements. Damper schedules may be submitted in advance but shall be included in the complete submittal.

e. The HVAC control system schematics shall show all control and mechanical devices associated with the HVAC system. A system schematic drawing shall be submitted for each HVAC system.

f. The HVAC control system equipment Schedule shall be developed. All devices shall have unique identifiers and shall be

referenced in the equipment schedule. Information to be included in the equipment schedule shall be the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e., output range). An equipment schedule shall be submitted for each HVAC system.

g. The HVAC control system sequence of operation shall reflect the language and format of this specification, and shall refer to the devices by their unique identifiers as shown on the contract drawings. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. Sequences of operation shall be submitted for each HVAC control system including each type of terminal unit control system.

h. The HVAC control system wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

SD-03 Product Data

DDC hardware; G

DDC capabilities; G

VARIABLE FREQUENCY 3 PHASE MOTOR DRIVES; G

Workstation software; G

Input devices; G

Output devices; G

Surge and Transient Protection; G

Notebook computer; G

Smoke detectors; G

SD-06 Test Reports

Field Tests; G

Commissioning Report

Three copies of the HVAC control system commissioning procedures, in booklet form and indexed, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal unit control system. The Commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as provided by the contractor, or if applicable, as shown. The Commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system as indicated in paragraph "Field Quality Control Tests".

a. The Commissioning procedures shall include detailed, product specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.

b. An HVAC control system commissioning procedures equipment list shall be included that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Tests; G

Three copies of the HVAC Control System Performance Verification Test Procedures, in booklet form and indexed, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation, paragraph "Field Quality Control Tests" and other contract documents. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training

Three copies of an outline for the HVAC control system training course with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training. Ten copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course.

SD-07 Certificates

Contractors Qualifications; G

Training; G

SD-10 Operation and Maintenance Data

Controls and HVAC System Operators Manual; G

Provide three copies of a Control and HVAC Systems Operators Manual. Provide in a 3 ring binder with a minimum of the following 7 sections. Use tabs to divide each section.

a. Description of HVAC Systems: Provide a description of the HVAC system components and control system. Include sequence of operation and a complete points list.

b. Controls Drawings: Provide drawings as specified in submittal paragraph.

c. Control Program Listings: Provide listing of all control programs, including terminal equipment controller setup pages if used.

d. Current Operating Parameters: Provide printouts of input and output setup information, (database setups). This section provides information such as point addresses, slopes and offsets for all points, database of points, etc.

e. Design Information: Provide tab, but leave this section blank.

f. Control Equipment Technical Data Sheets: Provide technical data sheets for all controller hardware and accessories.

g. Backup of Control Program: Provide backup copies of the control program (including as-built database) and AutoCAD control drawings on CD-ROM.

DDC Manufacturer's Hardware and Software Manuals; G

Provide three copies of the following manuals.

a. Installation and Technical Manuals for all digital controller hardware.

b. Installation and Technical Manuals for workstation.

c. Operator Manuals for all digital controllers.

d. Operator Manuals for all workstation software.

e. Programming Manuals for all digital controllers.

f. Programming Manuals for workstation software.

g. In addition to hard copy manuals, provide copy of manuals on removable media disk in Adobe Acrobat .pdf format.

SD-11 Closeout Submittals

Posted operating instructions:

Provide administrative and closeout submittals:

Training Course Documentation; G

Service organizations; G

Contractor certification; G

1.6 Operating environment

Protect components from humidity and temperature variations, dust, and other contaminants, within limits published by the manufacturer.

1.7 QUALITY ASSURANCE

1.7.1 Standard Products

a. Material and equipment shall be standard products of manufacturer regularly engaged in the manufacturing of such product, using similar materials, design and workmanship. The standard products shall have been in commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of similarly sized equipment and materials used under similar circumstances and sold on the commercial market through advertisements, manufacturers' catalogs, or brochures.

b. Products are supported by a local service organization.

1.7.2 Nameplates and Tags

a. Nameplates and tags bearing device unique identifiers shall be engraved or stamped. Permanently attach nameplates to HVAC control panel doors and back plates.

b. For each field mounted piece of equipment attach a plastic or metal tag with equipment name and point identifier.

1.7.3 Verification of Dimensions

The contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing work.

1.7.4 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work, and shall furnish all work necessary to meet such conditions.

1.7.5 Contractors Qualifications

The Contractor or subcontractor(s) performing the work shall have completed at least five DDC systems installations of a similar design and complexity and have successfully completed at least five Tridium integrations using both LonMark controllers and BACnet systems with the use of JDE programming software running on the Niagara platform.

1.7.6 Training Course Documentation

Training course documentation shall include a manual for each trainee plus two additional copies and two copies of audiovisual training aids (DVD format). Documentation shall include an agenda, defined objectives for each lesson and detailed description of the subject matter of each lesson.

1.7.7 Service Organizations

Qualified service organization list shall include the names and telephone numbers of organizations qualified to service the HVAC control systems.

1.7.8 Contractor Certification

Provide certification that installation of the control system is complete and meets the technical requirements of this section.

1.7.9 Modification of References

The advisory provision in ASME B31.1 and NFPA 70 are mandatory. Substitute the word "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 DDC SYSTEM

a. Provide a DDC system as a distributed control system. The system shall have stand-alone Interoperable LonMark (TM) or LonWorks, or BACnet digital controllers, a communications Network , and a separate workstation computer with Web Supervisor workstation software. LonMark/LonWorks controllers and, or BACnet controllers shall be connected to a Tridium JACE Network Area Controller (provided by controls contractor) to be node licensed to the existing Fort Lewis UMCS Master Web Supervisor.

b. Provide an operator programmable system to perform closed-loop, modulating control of building equipment. Connect all digital controllers through the communication network to share common data

and report to workstation computers. Provide Web Supervisor software on the DDC workstation capable of programming and monitoring the digital controllers. The control system shall be capable of downloading programs between the workstation and digital controllers.

c. Provide the quantity of digital controllers as required to perform the sequences of operation, or where shown, or as indicated on the drawings to perform required climate control, energy management, and alarm functions. The quantity of controllers shall be no less than that required to perform the sequences of operation within the parameters indicated in these specifications and contract drawings. All material used shall be currently in production.

2.1.1 Interoperable Direct Digital Controllers

DDC hardware shall be UL 916 rated. Interoperable controllers (IDC's) shall be LonMark (TM) or LonWorks bearing the applicable LonMark (TM) interoperability logo and shall be compatible with the Niagara Framework (a Tridium partner). Where LonMark (TM) devices are not available, devices based on LonWorks are acceptable providing that the controllers are programmable or configurable though the JACE controller. Interoperable BACnet Controllers (IBC's) shall be in accordance with ASHRAE 135 and shall be compatible with the Niagara Framework (a Tridium partner). IBC's must be provided with product interoperability compliance statement documents that demonstrate the compliance level to ASHRAE 135.

2.1.1.1 Distributed Control

Apply digital controllers in a distributed control manner.

2.1.1.2 I/O Point Limitation

Total number of I/O hardware points, including those communicated over a LAN, used by a single stand-alone digital controller, including I/O expansion units shall not exceed 48.

2.1.1.3 Environmental Operating Limits

Provide digital controllers that operate in environmental conditions between 32 and 120 degrees F.

2.1.1.4 Stand-Alone Control

Provide stand-alone digital controllers.

2.1.1.5 Internal Clock

Provide a clock with each stand-alone controller. Each controller shall have its clock backed up by a battery or capacitor with sufficient capacity to maintain clock operation for a minimum of 72 hours during power outage.

2.1.1.6 Memory

a. Provide sufficient memory for each controller to support required control, communication, trends, alarms, and messages

b. Memory Protection: Programs residing in memory shall be protected either by using EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply (UPS)). The backup power source shall have sufficient capacity to maintain volatile memory during an AC power failure. Where the uninterruptible power source is rechargeable (a rechargeable battery), provide sufficient back-up capacity for a minimum of seventy-two hours. The rechargeable power source shall be constantly charged while the controller is operating under normal line power. Where a non-rechargeable power source is used, provide sufficient capacity for a minimum of two years accumulated power failure. Batteries shall be replaceable without soldering.

2.1.1.7 Inputs

Provide input function integral to the direct digital controller. Provide input type(s) as required by the DDC design. For each type of input used on high-level controllers, provide at least one similar spare input point per controller.

a. Analog Inputs: Allowable input types are 100 ohm (or higher) platinum RTDs, thermistors, 4 to 20 mA, and 0-10 VDC. Thermistor and direct RTD inputs must have appropriate conversion curves stored in controller software or firmware. Analog to digital (A/D) conversion shall have 10-bit minimum resolution.

b. Digital Inputs: Digital inputs shall sense open/close, on/off, or other two state indications.

2.1.1.8 Outputs

Provide output function integral to the direct digital controller. Provide output type(s) as required by the DDC design. For each type of output used on high-level controllers, provide at least one similar spare output point per controller.

a. Analog Outputs: Provide controllers with a minimum output resolution of 10 bits. Output shall be 4 to 20 mA or 0 to 10 VDC.

b. Digital Outputs: Provide contact closure with contacts rated at a minimum of 1 ampere at 24 volts.

2.1.1.9 PID Control

Provide controllers with proportional integral, and derivative control capability. Terminal controllers are not required to have the derivative component.

2.1.1.10 Digital Controller Networking Capabilities

The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ASHRAE 135 BACnet and LonWorks technology communication protocols in one open, interoperable system. The upper level digital controllers shall be Tridium JACE controllers capable of networking with the existing Public Works network of JACE controllers at Fort Lewis. Upper level controllers shall also be capable of communicating over Fort Lewis Ethernet WAN and V-LAN network between buildings.

a. LonMark (TM) IDC Networking Capabilities

The contractor shall run the LonWorks network trunk to the nearest JACE Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

b. IBC Networking Capabilities

The system supplier must provide a PICS document showing the installed systems compliance level to the ASHRAE 135, to the Division 17 contractor. Minimum compliance is Level 3.

Physical connection of BACnet devices shall be via Ethernet.

The IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the portable operators terminal (POT).

2.1.1.11 Communications Ports

a. Controller-to-Controller LAN Communications Ports: Controllers in the building DDC system shall be connected in a communications network. Controllers shall have controller to controller communication ports to both peer controllers (upper level controllers) and terminal controllers (lower level controllers). Network may consist of more than one level of local area network and one level may have multiple drops. Communications network shall permit sharing information between controllers, allowing execution of dynamic control strategies, and coordinated response to alarm conditions. Minimum baud rate for the lowest level LAN shall be 9600 Baud. Minimum baud rate for the highest level LAN shall be 9600 Baud. Minimum baud rate for a DDC system consisting

of a single LAN shall be 9600 Baud.

b. On-Site Interface Ports: Provide a RS-232, RS-485, or RJ-11 communications port for each digital controller that allows direct connection of a computer and through which the controller may be fully accessed. Controller access shall not be limited to access through another controller. On-site interface communication ports shall be in addition to the communications port(s) supporting controller to controller communications. Communication rate shall be 9600 Baud minimum. Every controller on the highest level LAN shall have a communications port supporting direct connection of a computer; a hand held terminal port is not sufficient. The following operations shall be available: downloading and uploading control programs, modifying programs and program data base, and retrieving or accepting trend reports, status reports, messages, and alarms.

c. Remote Work Station Interface Port: Provide one additional direct connect computer port in each DDC system for permanent connection of a remote operator's workstation, unless the workstation is a node on the LAN. All operations possible by directly connecting a computer to a controller at the highest level LAN shall be available through this port.

d. Communications Interface Port: Provide one additional telecommunications port in each DDC system permitting remote communications via Ethernet. All operations possible by directly connecting a computer to a controller at the highest level LAN shall be available through the communications port. A communications port provided on a digital controller shall be in addition to the port required for directly connecting a computer to the controller. Communication baud rate shall be 28000 minimum.

2.1.1.12 Modem

Where no network connections are possible, provide two modems per DDC system to communicate between the digital control system and the computer workstation. Minimum modem baud rate is 56 Kbaud with v.90 communication standard.

2.1.1.13 Digital Controller Cabinet

Each indoor digital controller cabinet shall protect the controller from damage and shall be rated NEMA 1. Cabinets for controllers, including maintenance controllers located in and outside the Mechanical Room, shall have hinged door, be lockable, of welded construction, be sized for at least a 16" monitor, include an internal fan and removable filter, and have a removable metal back plate. Slide-out keyboard drawer shall also be lockable. All doors shall be keyed alike. Cabinet shall be bolted by the contractor to a floor mounted pad where indicated, and be suitably braced for seismic loads.

2.1.1.14 Main Power Switch

Each controller on the highest level LAN or each control cabinet shall have a main external power switch for isolation of the controller from AC power. The switch shall be located in the DDC cabinet and shall be labeled.

2.1.2 Terminal Control Units (TCUs)

a. The same company as the digital controllers shall manufacture TCUs.

b. TCUs shall automatically start-up on return of power after a failure, and previous operating parameters shall exist or shall be automatically downloaded from a digital controller on a higher level LAN.

c. TCUs do not require an internal clock if they get time information from a higher level digital controller.

2.1.3 DDC Software

The Contracting Officer's representative shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Fort Lewis as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ASHRAE 135, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 6; with the ability to support data read and write functionality. All integration and programming shall be via the Niagara Framework network engineering software tools, JDE (Java Desktop Environment).

2.1.3.1 Sequence of Control

Provide, in the digital controllers, software to execute the sequence of control. Provide one registered copy of all software used to program control sequences in direct digital controllers, LAN controllers and field configurable smart controllers on the stationary workstation. Provide any access keys which restrict programming language software functions or the ability to compile or prepare programming for download to controllers while editing parameters offline. Provide final copy of each program used in the system in both compiled and editable formats. Where specially programmed factory configured smart controllers are used in the system, provide the minimum factory programming tools and specialized controller programs ready for download to replacement controllers. At minimum, controllers must be capable of performing programming functions outlined in the following "Parameter Modification" section. The units for graphic display, parameter modification and maintenance interface shall be English, even if the project is a metric design.

2.1.3.2 Parameter Modification

Provide software capable of modifying all control parameters. Parameter modification shall be accomplished for all controllers (high level and low level application specific) through the main workstation computer and with laptop computer or keypad terminal directly at each controller. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Modifications shall be accomplished without having to make changes directly in line-by-line programming. When the control program is of the line-by-line type, database parameters in the following list that take real number values shall require assignment of variable names so parameters can be changed without modifying programming. Alternatively, block programming languages shall provide for modification of these database parameters in fill-in-the-blank screens. Parameters of like type, including those in different high level and low level controllers, may be grouped together for a single, global change. For example, an operator may group all second floor space temperature setpoints into a group and raise the setpoint by two degrees with a single command. The following parameters shall be modifiable in this way:

a. Setpoints (using English units)

b. Dead band limits and spans

c. Reset schedules

d. Switchover points

e. PID gains and time between control output changes

f. Time

g. Timed local override time

h. Occupancy schedules

i. Holidays

j. Alarm points, alarm limits, and alarm messages

k. Point definition database

l. Point enable, disable, and override

m. Trend points, trend intervals, trend reports

n. Analog input default values

o. Passwords

p. Communications parameters including network and telephone communications setups

2.1.3.3 Differential

Where setpoint is in response to some analog input such as temperature, pressure, or humidity, include a setpoint differential for the control loop to prevent short cycling of control devices.

2.1.3.4 Motor and Flow Status Delay

Provide an adjustable delay between when a motor is commanded on or off and when the control program looks to the motor or flow status input for confirmation of successful command execution.

2.1.3.5 Run time Accumulation

Provide resettable run time accumulation for each controlled digital output.

2.1.3.6 Timed Local Override

Provide user definable adjustable run time for each push of a momentary contact timed local override. Pushes shall be cumulative with each push designating the same length of time. Provide a user definable limit on the number of contact closures summed, such as 6, before the contact closures are ignored. Timed local overrides are disabled during occupancy periods.

2.1.3.7 Time Programs

Provide programs to automatically adjust for leap years, and make daylight savings time and standard time adjustments.

2.1.3.8 Scheduling

a. Individual controlled equipment shall be schedulable with schedule based on time of day, day of week, and day of year. Equipment may be associated into groups. Each group may be associated with a different schedule. Changing the schedule of a group shall change the schedule of all equipment in the group. Groups may be modified, created and deleted by the operator.

b. Provide capability that will allow current schedules to be viewed and modified in a seven-day week format. When control program does not automatically compute holidays, provide capability to enter holiday schedules one full year at a time.

2.1.3.9 Point Override

I/O and virtual points shall accept software overrides to any possible value.

2.1.3.10 Alarming

I/O points and software points shall be alarmable. Alarms may be enabled and disabled for every point and shall be initiated as shown on the Point

Schedule. Alarm limits shall be adjustable on analog points. Controllers connected to an external communications device such as a printer, terminal, or computer, shall download alarm and alarm message when alarm occurs. When a computer workstation is connected to a DDC system with a modem, operator selected alarm conditions will initiate a call and report alarms to the computer. Otherwise alarms will be stored and automatically downloaded via the Vykon Alarm Client when a communications link occurs. Alarm matrix shall follow that shown in Appendix B. The following conditions shall generate alarms:

a. Motor is commanded on or off but the motor status input indicates no change

b. Temperature, humidity, or pressure strays outside selectable limits

c. An analog input takes a value indicating sensor failure

d. A module is not communicating on the LAN

e. A power outage occurs

2.1.3.11 Messages

Messages shall be operator defined and assigned to alarm or status conditions. Messages shall be displayed on the workstation or printer when these conditions occur.

2.1.3.12 Trending

DDC system shall have the capability to trend all I/O and virtual points. Trend logs shall be initiated for the points identified in the Point Schedule. Points may be associated into groups. A trend report may be set up for each group. The period between logging consecutive trend values shall range from one minute to 60 minutes at a minimum. The minimum number of consecutive trend values stored at one time shall be 30 per variable. When trend memory is full, the most recent data shall overwrite the oldest data. Trend data shall be capable of being uploaded to computer. Trend data shall be available on a real time basis; trend data shall appear numerically and graphically on a connected computer's screen as the data is processed from the DDC system. Trend reports shall be capable of uploading to computer for storage.

2.1.3.13 Status Display

Current status of I/O and virtual points shall be displayed on command. Points shall be associated into functional groups, such as all the I/O and virtual points associated with control of a single air handling unit, and displayed as a group, so the status of a single mechanical system can be readily checked. A group shall be selectable from a menu of groups having meaningful names; such as AHU-4, Second Floor, Chiller System, and other such names.

2.1.3.14 Diagnostics

Each controller shall perform self-diagnostic routines and provide messages to an operator when errors are detected. The DDC system shall be capable of recognizing a non-responsive module on a LAN. The remaining, responsive modules on a LAN shall not operate in a degraded mode.

2.1.3.15 Power Loss

During a power outage, each controller shall assume a disabled status and outputs shall go to a user definable state. Upon restoration of power, DDC system shall perform an orderly restart, with sequencing of outputs.

2.1.3.16 Program Transfer

Provide software for download of control programs and database from a computer to controllers and upload of same to computer from controllers. Every digital controller in the DDC system shall be capable of being downloaded and uploaded to through a single controller on the highest level LAN.

2.1.3.17 Password Protection

Provide at least three levels of password protection to the DDC system permitting different levels of access to the system. The lowest level allows monitoring only. The highest level allows full control of all functions, including setting new passwords. Password Protection matrix shall follow that shown in Appendix B.

2.1.4 Workstation

a. Provide a central workstation computer installed with Web Supervisor JDE software to provide an interface for monitoring, troubleshooting, and making adjustments to the program or operating parameters of all DDC controllers, including TCUs. The workstation shall also be capable of programming all controllers, including TCUs.

b. DDC system shall operate continuously without connection to the workstation. Information at the workstation is not required for day-to-day operations of the direct digital controllers.

2.1.4.1 Hardware

The DDC system manufacturer shall ensure compatibility of all workstation computer equipment and peripherals. The workstation shall be configured to operate according to the DDC system manufacturer's specifications. Workstation hardware shall be configured to allow operation of software, uploading and downloading of programs, and creation of graphics. At a minimum the workstation hardware shall consist of:

a. Computer; computer shall use Microsoft Windows XP Professional with Service Pack 2 or higher, and shall not have less than Intel Pentium IV processor, running at 3.2 gigahertz speed, 160 gigabyte hard disc, 1 gigabyte RAM, 1 serial and 1 parallel port, one Ethernet port, one modem/telephone RJ-11 port, 4 USB 2.0 ports,

one IEEE 1394 (firewire) connection, 17 inch flat panel monitor with 1280 x 1024 minimum resolution, 101 character keyboard, a 1.4 megabyte 3 1/2 inch floppy drive, 48X internal CD R/W DVD combo drive, onboard or 8x graphics.

b. Optical Mouse, three button with scroll wheel. PS2 mouse connection with USB 2.0 connection adapter.

c. Modem: Minimum modem baud rate of 56 Kbaud with v.90 communication standard.

d. Multifunction Printer with Printer/Scanner/Copier functions, 4800 x 1200 dpi, color/B&W. Printer resolution shall be laser quality. Parallel and USB 2.0 connections.

e. 120-volt terminal strip UL 1449 6-outlet with surge protection.

2.1.4.2 Software

Workstation software shall be Web Supervisor with the appropriate JDE (Java Desktop Environment) services and configured to operate according to the DDC system manufacturer's specifications. Software shall be resident in the workstation computer and permit monitoring, programming and troubleshooting of the DDC system. Workstation software permits modification of controller parameters and control for all controllers, both high level and low level application specific. Operations shall be menu selected. Menu selections shall be made with a mouse.

a. Menu System: Menu system shall allow an operator to select a particular function or access a particular screen through successive menu penetration.

b. Controller Parameter Modification: The workstation software shall be an interface for performance specified in paragraph entitled "Parameter Modification" and available through direct connection of a computer to a digital controller. Parameter modification shall require only that an operator "fill in the blank" for a parameter on a screen requesting the information in plain language. Parameter modifications shall download to the appropriate controllers at operator request.

c. Program modification: All systems shall use block programming languages that provide a capability for linking blocks together to create new programs or modify existing programs. Program modifications shall download to appropriate controllers at operator request.

d. Provide a current version of anti-virus software recommended by the manufacturer of the computer operating system. Program shall verify that the computer is virus free upon delivery to the quality assurance representative (QAR).

2.1.4.3 Graphic-Based Software

The workstation shall use graphic-based software to provide a user-friendly interface to the DDC system. Graphic-based software shall provide graphical representation of the building, the buildings mechanical systems, and the DDC system. The current value and point name of every I/O point shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

a. Graphics shall follow the style of the screen shots in Appendix A in representing mechanical systems, sensors, controlled devices, point names, colors, fonts, navigation buttons, etc. Graphics shall utilize the standard library included in the JDE/Web Supervisor software.

b. Graphic Title: Graphics shall have an identifying title visible when the graphic is being viewed.

c. Dynamic Update: When the workstation is on-line with the control system, point data shall update dynamically on the graphic images.

d. Graphic Penetration: Provide graphic penetration when the capability exists. For systems without graphic penetration, provide menu penetration for selection of individual graphics to give the same hierarchical affect provided by graphic penetration.

e. Graphic Types: Graphic-based software shall have graphics of the building exterior, building section, floor plans, and mechanical systems. Provide the following graphics:

(1) Building Exterior Graphic: Show exterior architecture, major landmarks, and building number.

(2) Building Section Graphic: Show floors in section graphic with appropriate floor name on each floor.

(3) Floor Plan Graphics: Provide a single graphic for each floor, unless the graphic will contain more information than can reasonably be shown on a single graphic. Each heating or cooling zone within a floor plan shall have a zone name and its current temperature displayed within the zone outline. Show each controlled variable in the zone. Provide visual warning for each point in alarm.

(4) Mechanical System Graphics: Provide two-dimensional drawings to symbolize mechanical equipment; do not use line drawings. Show controlled or sensed mechanical equipment. Each graphic shall consist of a single mechanical system; examples are a graphic for an air handling unit, a graphic for a VAV box, a graphic for a heating water system, and a graphic for a chiller system. Place sensors and controlled devices associated with mechanical equipment in their appropriate locations. Place point name and point value adjacent to sensor or controlled device. Provide visual warning of each point in alarm. Condition, such as zone temperature, associated with the mechanical system shall be shown on the graphic. Point values shall update dynamically on the

graphic.

f. Graphic Editing: Full capacity as provided by a draw software package shall be included for operator editing of graphics. Graphics may be created, deleted, modified, and text added. Provide capability to store graphic symbols in a symbol directory and import these symbols into graphics. A minimum of 256 colors shall be available.

g. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on graphics.

h. Trending: Trend data shall be displayed graphically, with control variable and process variable plotted as functions of time on the same chart. Graphic display of trend data shall be internal to the workstation software and not resulting from download of trend data into a third-party spreadsheet program such as Excel, unless such transfer is automatic and transparent to the operator, and the third-party software is included with the workstation software package. At the operator's discretion, trend data shall be plotted real time.

2.1.5 Maintenance Personnel Interface Tools

Provide a notebook computer for field communication with the digital controllers. In addition to changing setpoints, and making operational changes, field personnel shall be able to download programs with the notebook computer.

2.1.5.1 Notebook Computer

a. Provide notebook computer, JDE (Java Desktop Environment) software, and direct connection cable to communicate with all digital controllers and smart thermostats when directly connected.

b. Provide notebook computer with the following features as a minimum:

(1) Pentium IV 3.0 GHz with active matrix color screen

(2) Internal hard disk; minimum 60 Gigabytes

(3) Internal battery operation; for a minimum of 3 hours of operation.

(4) RAM; minimum 512 Megabytes

(5) Internal 48X CDRW and 3.5 inch 1.44 MB floppy drive

(6) Serial interface port to communicate with the digital controller. A minimum of 2 USB 2.0 connections, parallel port to communicate with a printer and an Ethernet port to communicate with the NAC. PCMCIA port. Telephone/modem port.

(7) Software: One licensed copy of the JDE enabling editing of

programs offline, graphics DDC software, and all other required programs installed. Windows XP Professional with Service Pack 2 or higher operating system installed. Include all documentation and original media.

2.2 SENSORS AND INPUT HARDWARE

2.2.1 Field Installed Temperature Sensors

2.2.1.1 Thermistors

Precision thermistors may be used in temperature sensing applications below 93 degrees C. Sensor accuracy over the application range shall be 0.2 degree C or less between the range of 0 to 66 degrees C. Stability error of the thermistor over five years shall not exceed 0.14 degrees C cumulative. Sensor element and leads shall be encapsulated. Bead thermistors are not allowed. A/D conversion resolution error shall be kept to 0.06 degree C. Total error for a thermistor circuit shall not exceed 0.28 degree C, which includes sensor error and digital controller A/D conversion resolution error. Provide 18 gage twisted and shielded cable for thermistors.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with 1000 ohm, or higher, platinum elements that are compatible with the digital controllers. Sensors shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 0 degrees C. Temperature sensor stability error over five years shall not exceed 0.14 degree C cumulative. Direct connection of RTDs to digital controllers, without transmitters, is preferred provided controller supports direct connection of RTDs. When RTDs are connected directly to the controller, keep lead resistance error to 0.14 degree C or less. Total error for a RTD circuit shall not exceed 0.28 degree C, which includes sensor error, lead resistance error or 4 to 20 mA or 0 to 10 VDC transmitter error, and A/D conversion resolution error.

2.2.1.3 Temperature Sensor Details

a. Room Type: Conceal element behind protective cover matched to the room interior. Room temperature sensors connected directly to application specific controllers shall have integral pushbutton, system override digital input button, and a setpoint adjustment lever.

b. Duct Averaging Type: Continuous averaging RTDs for ductwork applications shall be 30 centimeters in length for each 0.37 square meters of ductwork cross-sectional area with a minimum length of 1.8 meter. Probe type duct sensors of 30 centimeter length minimum are acceptable in ducts 1.1 square meter and less.

c. Immersion Type: 75 mm total immersion for use with sensor wells, unless otherwise indicated.

d. Sensor Wells: Stainless steel material. Provide heat-sensitive transfer agent between exterior sensor surface and interior well surface.

e. Outside Air Type: Provide element on the buildings north side with sunshade to minimize solar effects. Mount element at least 75 mm from building outside wall. Sunshade shall not inhibit the flow of ambient air across the sensing element. Shade shall protect sensing element from snow, ice, and rain.

2.2.2 Transmitters

Transmitters shall have 4 to 20 mA or 0 to 10 VDC output linearly scaled to the temperature, pressure, humidity, or flow range sensed. Transmitter shall be matched to the sensor, factory calibrated, and sealed. Total error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter stability shall not exceed 0.05 degrees C (0.09 degrees F)a year.

2.2.2.1 Spans and Ranges

Transmitter spans or ranges shall meet the following:

a. Temperature:

(1) 28 degrees C span: Room, chilled water, cooling coil discharge air, return air sensors

(2) 56 degrees C span: Outside air, hot water, heating coil discharge air, mixed air sensors

(3) 111 degrees C span: High temperature hot water, heating hot water, chilled/hot water system sensors.

b. Pressure:

(1) -125 to 125 pascals differential range: static pressure control of rooms

(2) 0 to 1250 pascals differential range: Duct static pressure

(3) 0 to 689 kPa differential: Water differential pressure

c. Relative Humidity:

(1) 10 to 90 percent minimum relative humidity range

2.2.3 Relative Humidity Transmitters

Provide integral humidity transducer and transmitter. Output of relative humidity instrument shall be a 4 to 20 mA or 0 to 10 VDC signal proportional to full range of relative humidity input. Accuracy shall be 2

percent of full scale, long-term stability shall be less than one percent drift per year. Sensing element shall be polymer or thin film polymer type.

2.2.4 Pressure Transmitters

Provide integral pressure transducer and transmitter. Output of pressure instrument shall be a 4 to 20 mA or 0 to 10 VDC signal proportional to the pressure span. Span shall be as specified. Accuracy shall be 1.0 percent. Linearity shall be 0.1 percent.

2.2.5 Current Transducers

Provide current transducers to monitor amperage of motors. Select current transducer for normal measured amperage to be near 50 percent of full-scale range. Current transducers shall have an accuracy of one percent and 4 to 20 mA or 0 to 10 VDC output signal.

2.2.6 Air Quality Sensors

2.2.6.1 Carbon Dioxide (CO2) Sensor

Provide carbon dioxide (CO2) sensors with integral transducers where shown or as required by the sequence of operations. Output signal shall be 4 to 20 mA or 0 to 10 VDC. Accuracy shall be ±5 percent of full scale.

2.2.7 Input Switches

2.2.7.1 Timed Local Override

Provide momentary contact push button override with override time set in controller software. Provide to override DDC time of day program and activate occupancy program for assigned units. Upon expiration of override time, the control system shall return to time-of-day program. Time interval for the length of operation shall be software adjustable and shall expire unless reset.

2.2.7.2 Insertion Freeze Protection Switch

Electric switch shall be capillary type. Provide special purpose insertion thermostats with flexible elements a minimum of 6 meters in length for coil face areas up to 3.7 square meters. Switch contacts shall be rated for motor starter circuit voltage being interrupted. Switch shall be equipped with auxiliary set of contacts for input of switch status to digital controller. Provide additional elements or longer elements for larger coils at the rate of 30 centimeters of element per 0.37 square meters of coil. Serpentine capillaries perpendicular to the air flow to uniformly sense the entire airflow. A freezing condition at 45-centimeter increments along the sensing element shall activate the thermostatic switch. Switch shall require manual reset after activation.

2.2.7.3 Electronic Airflow Measurement Stations and Transmitters

a. Station - Each station shall contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal

casing. The velocity sensing elements shall be of the RTD or thermistor type. The sensing elements shall be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE Gdln3 and SMACNA HVACTAB for the traversing of ducted air flows. The resistance to airflow through the airflow measurement station shall not exceed 20 pascals at an airflow of 10.16 meters per second. Station construction shall be suitable for operation at airflow of up to 25.4 meters per second over a temperature range of 4 to 49 degrees C, and accuracy shall be plus or minus 3 percent over a range of 0.635 to 12.7 meters per second scaled to air volume.

b. Each transmitter shall produce a linear, temperature compensated 4 to 20 mA or 0 to 10 VDC output corresponding to the actual air flow. The transmitter shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement.

2.2.8 Energy Metering

2.2.8.1 Meters

All utilities including water and electricity shall be monitored. Integrate utility meter signals into DDC system; meter signal output must be compatible with LonMark/LonWorks profiles. DDC shall measure both instantaneous and accumulated electrical usage. Coordinate output signals for DDC with utility meters indicated below.

a. Electrical meter shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

b. Water meter shall be as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

2.3 OUTPUT HARDWARE

2.3.1 Dampers

Damper shall conform to SMACNA HVAC Duct Const Stds.

a. A single damper section shall have blades no longer than 1220 mm and shall be no higher than 1830 mm. Maximum damper blade width shall be 203 mm. Larger sized damper shall be made from a combination of sections.

b. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blades shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 102 L/s per square meter at 996 Pa gage static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees C to 93 degrees C. Dampers shall be rated at not less

than 10 m/s air velocity. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 13 mm (minimum) plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 10 Pa gage at 5 m/s in the wide-open position. Frames shall not be less than 50 mm in width. Dampers shall be tested in accordance with AMCA 500-D.

c. Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Moving parts in contact with one another shall be of different materials. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed position of dampers.

2.3.2 Valves

2.3.2.1 Valve Assembly

Valves shall have stainless steel stems. Valves shall be ANSI Class 125 or ANSI Class 150, as required by the following pressure-temperature design criteria: 150 percent of the system operating pressure at the system operating temperature. Valve leakage rating shall be 0.01 percent of rated Cv. Class 125 copper alloy valve bodies and Class 150 steel or stainless steel valves shall conform to ASME B16.5 as a minimum. Cast iron valve components shall conform to ASTM A 126 Class B or C as a minimum.

2.3.2.2 Butterfly Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service and for modulation to the fully closed position, with noncorrosive discs, stainless steel shafts supported by bearing, and EPDM seats suitable for temperatures from minus 29 degrees C to plus 121 degrees C. Valves shall have a manual means of operation independent of the actuator.

2.3.2.3 Two-Way Valves

Two-way modulating valves shall have equal percentage characteristics.

2.3.2.4 Three-Way Valves

Three-way valves shall have equal percentage characteristics.

2.3.2.5 Duct Coil and Terminal Unit Coil Valves

Provide control valves with either flare-type or solder-type ends provided for duct or terminal-unit coils. Provide flare nuts for each flare-type end valve.

2.3.2.6 Valves for Hot Water Service

Valves for hot water service below 121 degrees C:

a. Bodies for valves 40 mm and smaller shall be brass or bronze with threaded or union ends. Bodies for valves larger than 50 mm shall have flanged-end connections. Water valves shall be sized for a 21 kPa differential through the valve at rated flow, except as indicated otherwise. Select valve flow coefficient Kv for an actual pressure drop not less than 50 percent or greater than 125 percent of the design pressure drop at design flow.

b. Internal trim, including seats, seat rings, modulation plugs, and springs, of valves controlling water hotter than 99 degrees C shall be Type 316 stainless steel.

c. Internal trim for valves controlling water 99 degrees C or less shall be brass or bronze.

d. Non-metallic parts of hot water control valves shall be suitable for a minimum continuous operating temperature of 121 degrees C or 28 degrees C above the system design temperature, whichever is higher.

e. Valves 100 mm and larger shall be butterfly valves.

2.3.3 Actuators

2.3.3.1 Electric Actuators

Provide direct drive electric actuators for all control applications. When operated at rated voltage, each actuator shall be capable of delivering torque required for continuous uniform motion and shall have end switch to limit travel, or shall withstand continuous stalling without damage. Actuators shall function properly with range of 85 to 110 percent of line voltage.

Provide gears manufactured from steel, copper alloy, fiber, or reinforced nylon. Provide hardened steel running shafts in sleeve bearing of copper alloy, hardened steel, nylon, or ball bearing. Provide two-position actuators of the single direction, spring return, or reversing type. Provide proportioning actuators capable of stopping at all points in the cycle and starting in either direction, from any point.

Provide reversing and proportioning actuators with limit switches to limit travel in either direction unless operator is stall type. Actuators shall have a simple switch for reversing direction, and a button to disengage clutch for manual adjustments. Provide reversible shaded pole, split capacitor, synchronous, or stepper type electric motors.

2.3.4 Output Switches

2.3.4.1 Control Relays

Shall be double pole, double throw (DPDT), UL listed, with contacts rated to the application, indicator light, and dust proof enclosure. Light indicator is lit when coil is energized and is off when coil is not energized. Relays shall be socket type, plug into a fixed base, and replaceable without need of tools or removing wiring. Encapsulated "PAM" type relays are permissible for terminal control applications.

2.3.4.2 Solenoid Air Valves

Each valve shall have three port operation: common, normally open, and normally closed. Internal parts shall be brass, bronze, or stainless steel. Valves shall be rated at 344 kPa minimum when used in a control system operating at 172 kPa or less, or 1034 kPa when used in a control system operating in the range .

2.4 ELECTRICAL POWER AND DISTRIBUTION

For control power provide a new, dedicated source, 120 volts or less, 60 Hz, three wire (black, white, and green). Run green ground wire to panel ground; conduit grounds are not sufficient.

2.4.1 Transformers

Transformers shall conform to UL 506. Power digital controllers and terminal control units (TCU's) from dedicated circuit breakers with surge protection specified. Transformers for digital controllers serving terminal equipment on lower level LANs may be grouped to have specified surge protection sized for the number of controllers on a single transformer. Provide a fuse on the secondary side of the transformer.

2.4.2 Surge Protection

Surge and transient protection consist of devices installed externally to digital controllers.

2.4.2.1 Power Line Surge Protection

Surge suppressors external to digital controller, shall be installed on all incoming AC power. Surge suppressor shall be rated by UL 1449, have a fault indicating light, and have clamping voltage ratings below the following levels:

a. Unit is a transient voltage surge suppressor 120 VAC/1 phase/2 wire plus ground, hard wire individual equipment protector.

b. Unit must react within 5 nanoseconds and automatically reset.

c. Voltage protection threshold, line to neutral, starts at no more than 211 volts peak on the 120 VAC line.

d. The transient voltage surge suppressor must have an independent secondary stage equal to or greater than the primary stage joule rating.

e. The primary suppression system components must be pure Silicon Avalanche Diodes.

f. Silicon Avalanche Diodes or Metal Oxide Varistors are acceptable in the independent secondary suppression system.

g. The Transient Suppression System shall incorporate an indication light which denotes whether the primary and/or secondary transient protection components is/are functioning.

h. All system functions of the Transient Suppression System must be individually fused and not short circuit the AC power line at any time.

i. The Transient Suppression System shall incorporate an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

j. The system must comply with IEEE C62.41, Class "B" requirements and be tested according to IEEE C62.45.

k. The system shall operate at -20 degrees C to +50 degrees C.

2.4.2.2 Telephone and Communication Line Surge Protection

Provide transient surge protection to protect the DDC controllers and LAN related devices from surges that occur on the phone lines (modem or direct connect) and on inter-unit LAN communications. Devices shall be UL listed.

a. The surge protection shall be a rugged package with continuous, non-interrupting protection and not use crowbar technology. Instant automatic reset after safely eliminating transient surges, induced lightning, and other forms of transient over voltages.

b. Unit must react within 5 nanoseconds using only solid-state silicone avalanche technology.

c. Unit shall be installed at the proper distance as recommended by the manufacturer.

2.4.2.3 Controller Input/Output Protection

Controller input/output points shall surge protection with optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.4.3 Wiring

Provide complete electric wiring for DDC System, including wiring to transformer primaries. Control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 Volts shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Circuits operating at 100 Volts or less shall be defined as low voltage and shall be run in rigid or flexible conduit, metallic tubing, metal raceways

or wire trays, armored cable, or multi-conductor cable. Provide circuit and wiring protection as required by NFPA 70. Aluminum-sheathed cable or aluminum conduit may be used but shall not be buried in concrete. Use conduit or plenum-rated cable in HVAC plenums. HVAC plenums include the space between a drop ceiling and the architectural ceiling, within walls, and within ductwork. Protect exposed wiring from abuse and damage.

2.4.3.1 AC Control Wiring

a. Control wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V shall be 14 AWG minimum and rated for 600 V service.

2.4.3.2 Analog Signal Wiring

Analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded, and have 20 AWG drain wire. Each wire shall have insulation rated to 300 V AC. Cables shall have an overall aluminum-polyester or tinned-copper (cable-shield tape). Install analog signal wiring in conduit separate from AC power circuits.

2.5 FIRE PROTECTION DEVICES

Provide smoke detectors in return and supply air ducts on downstream side of filters in accordance with NFPA 90A, except as otherwise indicated. Provide UL listed or FM approved detectors for duct installation.

2.5.1 Smoke Detectors

Provide in each air-handling system with supply air capacity greater than 944 L/s (2000 cfm) in accordance with NFPA 90A. Design for detection of abnormal smoke densities by the ionization or photoelectric principle, responsive to both invisible and visible particles of combustion, and not susceptible to operation by changes to relative humidity. Provide UL listed or FM approved detectors for duct installation. Provide duct detectors with an approved duct housing, mounted exterior to the duct, and with perforated sampling tubes extending across the width of the duct. Provide 115 VAC power supply unit integral with duct housing. Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s Detectors shall be powered from the HVAC control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted 2.44 meters or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as the affected fan units shall be properly identified in etched rigid plastic placards. Detectors shall have test port or test switch. Provide each detector with

a visible indicator lamp that lights when the detector is activated. Activation of duct detector shall cause shutdown of the associated air-handling unit and closing of dampers and shall sound an alarm bell, with minimum 152 mm diameter, in a normally occupied area located as directed. Provide a separate bell for each air handling unit, with an engraved plastic or metal label indicating which unit each bell annunciates.

2.6 INDICATORS

As a minimum, provide local liquid temperature, pressure, and flow indication at each coil, heat pump, heat exchanger, pump, and tank that is provided with a remote indication capability at the computer.

2.6.1 Thermometers

Provide bi-metal thermometers in locations as indicated. Bi-metal thermometers shall have either 23 centimeter scales or 9 centimeter dials and shall have insertion, immersion or averaging elements as indicated. Provide thermowells for liquid sensing applications. Select thermometer ranges so normal temperatures are approximately equal to midpoint readings on the scale.

2.6.2 Pressure Gages

Gages for low differential pressure measurements shall be 11.4 centimeter (nominal) size with two sets of pressure taps, and shall have a diaphragm actuated pointer, white dial with black figures, and pointer zero adjustment. Gage shall have ranges and graduations as appropriate for the application, or as shown. Accuracy shall be plus or minus 2 percent of scale range.

2.7 VARIABLE FREQUENCY 3 PHASE MOTOR DRIVES

The variable frequency drive (VFD) shall convert 208 or 460 volt (+/- 10%), three phase, 60 hertz (+/- 2Hz), utility grade power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5% to 105% of base speed.

2.7.1 Description

The variable frequency drive (VFD) shall produce an adjustable AC voltage/ frequency output for complete motor speed control. The VFD must meet all of the following criteria:

a. The VFD shall use sine coded Pulse Width Modulation (PWM) technology. The sine coded PWM calculations are performed by the VFD microprocessor.

b. The VFD shall use Insulated Gate Bipolar Transistors (IGBT) transistors for the inverter's three phase output.

c. The VFD shall use a three phase diode bridge converter to charge the VFD constant voltage capacitor buss.

d. The VFD shall have the ability for control by either a remote 4-20 mA or 0 to 10 VDC control signal or from a local control panel located on the VFD itself.

e. The VFD shall use microprocessor technology for VFD control. The VFD shall be programmable with a permanently mounted keypad included with each VFD.

f. The VFD shall be fully self diagnostic. No external programmers, analyzers, interrogators, or diagnostic boards, shall be needed to annunciate VFD faults or drive internal status.

2.7.2 Code Standards

VFD shall be UL listed as delivered to the end user. The VFD shall meet current National Electrical Code.

2.7.3 VFD Quality Assurance

To ensure quality, each and every VFD shall be subject to a series of in-plant quality controlled inspections before approval for shipment from the manufacture's facilities.

a. All components shall be tested prior to assembly and the complete unit shall be tested under full load conditions to ensure maximum product reliability.

b. The VFDs shall be the current standard production unit with at least 10 identical units already in the field.

c. Engineering support shall be available from the factory of the VFD. Phone support shall be free of charge to the end user for the life of the equipment. Factory support shall be available in the English language.

2.7.4 VFD Service

The VFD shall be supplied with:

a. 24 month parts and labor warranty. The warranty shall start when the system is accepted by the end user or 30 months from date of shipment.

b. Installation, operation, and troubleshooting guide(s).

c. A district service support group shall provide the following additional services:

(1) Factory trained personal on-site for start-up for up to one working day at no additional cost. Personnel shall be competent in operation and repair of the particular model of VFD that is installed.

(2) On-site training of customer personnel in basic installation,

troubleshooting, and operation of VFDs at no additional cost. This training shall be conducted for up to 6 personnel at the installation site for a minimum of 4 hours.

2.7.5 Basic VFD Features

The VFD shall have the following basic features with no more then three separate internal electronic boards.

a. VFD mounted operator control keypad capable of:

(1) Remote/Local operator selection with password access.

(2) Run/Stop and manual speed commands.

(3) All programming functions.

(4) Scrolling through all display functions.

b. Digital display capable of indicating:

(1) VFD status.

(2) Frequency.

(3) RPM of motor.

(4) Phase current.

(5) Fault diagnostics in descriptive text.

(6) All programmed parameters.

c. Standard PI loop controller with input terminal for controlled variable and parameter settings made while inverter running.

d. User interface terminals for end-user remote control of VFD speed, speed feedback, and isolated form C SPDT relay energized on drive fault condition.

e. An isolated form C SPDT auxiliary relay energized on run command.

f. The VFD shall have a metal NEMA 1 enclosure.

g. The VFD shall have an adjustable carrier frequency with 16 KHz minimum upper limit.

h. The VFD shall have a built in or external line reactor with 3% minimum impedance to protect DC buss capacitors and rectifier section diodes.

2.7.6 Programmable Parameters

The VFD shall include the following operator programmable parameters:

a. Upper limit frequency.

b. Lower limit frequency.

c. Acceleration rate.

d. Deceleration rate.

e. Variable torque volts per Hertz curve.

f. Starting voltage level.

g. Starting frequency level.

h. Display speed scaling.

i. Enable/disable auto-restart feature.

j. Enable/disable soft stall feature.

k. Motor overload level.

l. Motor stall level.

m. Jump frequency and hysteresis band.

n. PWM carrier frequency.

2.7.7 Protective Circuits and Features

a. An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.

b. An electronic adjustable soft stall feature, allowing the VFD to lower the frequency to a point were the motor will run at FLA when an overload condition exists at the requested frequency. The VFD will automatically return to the requested frequency when load condition permit.

c. The VFD will have a separate electronic stall at 110% VFD rated current and a separate hardware trip at 190% current.

d. The VFD shall have ground fault protection that protects output cables and motor from grounds during both starting and continuous running conditions.

e. The VFD shall have the ability to restart after the following faults:

(1) Overcurrent (drive or motor).

(2) Power outage.

(3) Phase loss.

(4) Overvoltage/Undervoltage.

e. The VFD shall restart into a rotating load without tripping or damaging the VFD or the motor.

f. The VFD shall keep a log of a minimum of four previous fault conditions, indicating type and time of occurrence in descriptive text.

g. The VFD shall be able to sustain 110% rated current for 60 sec.

h. The VFD shall respond to and record the following fault conditions:

(1) Over current (and have an indication if the over current was during acceleration, deceleration, or running).

(2) Overcurrent internal to the drive.

(3) Motor overload at start-up.

(4) Over voltage from the utility power.

(5) Motor running overload.

(6) Overvoltage during deceleration.

(7) VFD over heat.

(8) Load end ground fault.

(9) Abnormal parameters or data in VFD EEPROM.

2.7.8 Operational Conditions

The VFD shall be designed and constructed to operate within the following service conditions.

a. Ambient Temperature Range, -17.7 to 48.8 degrees C.

b. Non-condensing relative humidity to 90%.

2.7.9 Available Options

Provide the following options:

a. RFI/EMI filters

b. LonWorks or BACnet interface card with application software which can both control and monitor the VFD from an attached computer.

c. A manual bypass circuit and switch integral or external to the drive to allow drive bypass and operation at 100% speed. Overload fuses and other protective hardware shall remain in the circuit during bypass.

d. One set of spare parts per drive including: all replaceable circuit cards, power diode assemble, DC Buss capacitor, power output transistor assembly, all fuses, and all lights. Package parts individually for long term storage and clearly label contents.

PART 3 EXECUTION

3.1 INSTALLATION

Perform installation under supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 [Enter Appropriate Subpart Title Here]3.1.1 Wiring Criteria Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

a. Input/output identification: Permanently label each field wire, cable at each end with unique descriptive identification.

b. Rigid or flexible conduit shall be terminated at all sensors and output devices.

c. Surge Protection: Install surge protection per manufacturer's specification.

d. Grounding: Ground controllers and cabinets to a good earth ground. Ground controller to a ground in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Grounding of the green ac ground wire, at the breaker panel alone, is not adequate. Run metal conduit from controller panels to adequate building grounds. Ground sensor drain wire shields at controller end.

e. Contractor is responsible for correcting all associated ground loop problems.

f. Wiring in panel enclosures shall be run in covered wire track.

3.1.2 Digital Controllers

a. Do not divide control of a single mechanical system such as an air handling unit, boiler, chiller, or terminal equipment between two

or more controllers. A single controller shall manage control functions for a single mechanical system. It is permissible, however, to manage more than one mechanical system with a single controller.

b. Provide lockable digital control cabinets that protect digital controller electronics from dust and moisture as required by the manufacturer.

c. Controllers shall not be installed in elevator equipment or communication rooms.

3.1.3 Temperature Sensors

Provide temperature sensors in locations to sense the appropriate condition. Provide sensor where they are easy to access and service without special tools. Calibrate sensors to accuracy specified. In no case will sensors designed for one application be installed for another application.

3.1.3.1 Room Temperature Sensors

Provide on interior walls to sense average room temperature conditions. Avoid locations near heat sources or which may be covered by office furniture. Room temperature sensors shall not be mounted on exterior walls when other locations are available. Mount center of sensor at 1.52 meters(5 feet) above finished floor.

3.1.3.2 Duct Temperature Sensors

a. Provide sensors in ductwork in general locations as indicated. Select specific sensor location within duct to accurately sense appropriate air temperatures. Sensors shall not be located in dead air spaces or positions obstructed by ducts or equipment. Install gaskets between the sensor housing and duct wall. Seal duct and insulation penetrations.

b. String duct averaging sensors between two rigid supports in a serpentine position to sense average conditions. Insulate temperature sensing elements from supports. Provide hinged duct access doors to install averaging sensors if needed.

c. Locate freeze protection sensors in appropriate locations to sense lowest temperatures, to avoid potential problems with air stratification.

3.1.3.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring temperatures in liquid applications or pressure vessels. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping

size as required to avoid restriction. Provide thermowells with thermal transmission material within the well.

3.1.3.4 Outside Air Temperature Sensors

Provide outside air temperature sensor in weatherproof enclosure on north side of the building, away from exhaust hoods, air intakes and other areas that may affect temperature readings. Provide sun shields to from direct sunlight.

3.1.4 Damper Actuators

Actuators shall not be mounted in the air stream.

3.1.5 Thermometers

Provide thermometers at locations indicated. Mount thermometers to allow reading when standing on the floor.

3.1.6 Differential Pressure Sensors

a. Duct Static Pressure Sensing: Locate duct static pressure tip approximately two-thirds of distance from supply fan to end of duct with the greatest pressure drop.

b. Pumping Proof with Differential Pressure Switches: Install high pressure side between pump discharge and check valve.

c. Variable Speed Control: The cycle time and characteristics of the input signal from the differential pressure sensors shall be fully compatible with the variable speed controller. Coordinate the requirements with the provided associated equipment.

3.1.7 Control Drawings

a. Post laminated copies of as-built control system drawings in each mechanical room.

b. Provide 3 sets of as-built control drawings to the Contracting Officer.

3.2 TEST AND BALANCE SUPPORT

The Contractors Field Tests shall be completed and the control system fully functional prior to balancing. Controls contractor will coordinate with and provide full time on-site technical support to test and balance (TAB) personnel specified under Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS or any other documents in the project specification. This support shall include:

a. On-site operation of control systems for proper operating modes during all phases of balancing and testing.

b. Control setpoint adjustments for proper balancing of all relevant

mechanical systems, including VAV boxes.

c. Setting all control loops with setpoints and adjustments determined by TAB personnel.

3.3 FIELD QUALITY CONTROL TESTS

3.3.1 General

a. After loading software, and prior to connection to the WAN, the laptop and the workstation shall be tested and certified as virus free. Contractor shall coordinate with Fort Lewis Public Works Information Technology (IT) staff for security and configuration patches and virus scans prior to connecting the system on the WAN.

b. Obtain approval of the field test plan and performance verification test plan for each phase of testing before beginning that phase of testing. Give the Contracting Officer written notification of planned testing at least 30 days prior to test. Notification shall be accompanied by the proposed test procedures. In no case will the Contractor be allowed to start testing without written Government approval of field test plan and performance verification test plan.

c. Demonstrate compliance of the heating, ventilating, and air conditioning control system with the contract documents. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Ensure that test personnel are regularly employed in the testing and calibration of DDC systems.

d. Testing will include the field tests and the performance verification tests. Field tests shall demonstrate proper calibration of input and output devices, and the operation of specific equipment. Performance verification test shall ensure proper execution of the sequence of operation and proper tuning of control loops, as well as system communication.

e. Before scheduling the performance verification test, furnish field test documentation and written Certified Statement of Field Test Completion to the Contracting Officer for approval. The statement, certified by the DDC system provider, states that the installed system has been calibrated, tested, and is ready for the performance verification test. Do not start the performance verification test prior to receiving written permission from the Government.

f. Tests are subject to oversight and approval by the Contracting Officer. The testing shall not be run during scheduled seasonal off-periods of heating and cooling systems.

3.3.2 Test Reporting for Field Testing and Performance Verification Tests

a. During and after completion of the Field Tests, and again after

the Performance Verification Tests, identify, determine causes, replace, repair or calibrate equipment that fails to meet the specification, and submit a written report to the Government.

b. Document all tests with detailed test results. Explain in detail the nature of each failure and corrective action taken. Provide a written report containing test documentation after the Field Tests and again after the Performance Verification Tests. Convene a test review meeting at the job site to present the results to the Government. As part of this test review meeting, demonstrate by performing all portions of the field tests or performance verification test that each failure has been corrected. Based on the report and test review meeting, the Government will determine either the restart point or successful completion of testing. Do not retest until after receipt of written notification by the Government. At the conclusion of retest, assessment will be repeated.

3.3.3 Contractor's Field Tests

Field tests shall include the following:

3.3.3.1 System Inspection

Observe the HVAC system in its shutdown condition. Check dampers and valves for proper normal positions. Document each position for the test report.

3.3.3.2 Calibration Accuracy and Operation of Inputs Test

Verify correct calibration and operation of input instruments. For each sensor and transmitter, including those for temperature, pressure, humidity, and air quality, record the reading at the sensor or transmitter location using calibrated test equipment. On the same table, record the corresponding reading at the digital controller for the test report. The test equipment shall have been calibrated within one year of use. Test equipment calibration shall be traceable to the measurement standards of the National Institute of Standards and Technology.

3.3.3.3 Actuator Range Adjustment Test

With the digital controller, apply a control signal to each actuator and verify that the actuator operates properly from its normal position to full range of stroke position. Record actual spring ranges and normal positions for all modulating control valves and dampers. Include documentation in the test report.

3.3.3.4 Digital Controller Startup and Memory Test

Demonstrate that programming is not lost after a power failure, and digital controllers automatically resume proper control after a power failure.

3.3.3.5 Surge Protection Test

Show that surge protection, meeting the requirements of this specification, has been installed on incoming power to the digital controllers and on communications lines.

3.3.3.6 Application Software Operation Test

Test compliance of the application software for:

a. Ability to communicate with the digital controllers, uploading and downloading of control programs over the Fort Lewis Wide Area Network (WAN).

b. Text editing program: Demonstrate the ability to edit the control program off line.

c. Reporting of alarm conditions: Force alarms conditions for each alarm, and ensure workstation receives alarms within a suitable timeframe.

d. Reporting trend and status reports: Demonstrate ability of software to receive and save trend and status reports.

3.3.4 Performance Verification Tests

Balancing shall be complete prior to commencing Performance Verification Tests. Conduct the performance verification tests to demonstrate control system maintains setpoints, control loops are tuned, and controllers are programmed for the correct sequence of operation. Conduct performance verification test during seven days of continuous HVAC and DDC systems operation and before final acceptance of work. Specifically the performance verification test shall demonstrate the following:

3.3.4.1 Execution of Sequence of Operation

Demonstrate the HVAC system operates properly through the complete sequence of operation, for example seasonal, occupied/unoccupied, and warm-up. Demonstrate proper control system response for abnormal conditions by simulating these conditions. Demonstrate hardware interlocks and safeties work. Demonstrate the control system performs the correct sequence of control after a loss of power.

3.3.4.2 Control Loop Stability and Accuracy

Furnish the Government graphed trends of control loops to demonstrate the control loop is stable and that setpoint is maintained. Control loop response shall respond to setpoint changes and stabilize in 3 minutes. Control loop trend data shall be real time and the time between data points shall not be greater than one minute. The contractor shall provide a printer, either the project printer or temporary, at the job site for printing graphed trends. The printer shall remain on the job site throughout Performance Verification Testing to allow printing trends.

3.3.4.3 Workstation

Demonstrate the ability to monitor, command and modify the controlled systems, points, etc. Demonstrate capabilities specified in Paragraph 2.1.4, Workstation.

3.3.4.4 System Communication

Demonstrate system communication by downloading programs and configuring programs to controllers over the network from the workstation.

3.4 TRAINING

Submit a training course schedule, syllabus, and training materials 14 days prior to the start of training. Furnish a qualified instructor to conduct training courses for designated personnel in the maintenance and operation of the HVAC and DDC system. Orient training to the specific system being installed under this contract. Use operation and maintenance manual as the primary instructional aid in contractor provided activity personnel training. Base training on the Operations and Maintenance manuals and a DDC training manual. Manuals shall be delivered for each trainee with two additional sets delivered for archiving at the project site. Training manuals shall include an agenda, defined objectives and a detailed description of the subject matter for each lesson. Furnish audio-visual equipment and all other training materials and supplies. A training day is defined as 8 hours of classroom or lab instruction, including two 15 minute breaks and excluding lunch time, Tuesday through Thursday, during the daytime shift in effect at the training facility. For guidance, the Contractor should assume the attendees will have a high school education and are familiar with HVAC systems.

3.4.1 DDC Training Phase I

The first class shall be taught for a period of 2 consecutive training days at least 2 weeks prior to the scheduled Performance Verification Test. The first course shall be taught in a government provided facility on base. Training shall be classroom, but have hands-on operation of similar digital controllers. A maximum of 8 personnel will attend this course. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations, with guidance, and describe the general hardware architecture and functionality of the system. This course shall include but not be limited to:

a. Theory of operation

b. Hardware architecture

c. Operation of the system

d. Operator commands

e. Control sequence programming

f. Data base entry

g. Reports and logs

h. Alarm reports

i. Diagnostics

3.4.2 DDC Training Phase II

The second course shall be taught in the field, using the operating equipment at the project sites for a total of 2 consecutive days. A maximum of 8 personnel will attend the course. The course shall consist of hands-on training under the constant monitoring of the instructor. Course content shall duplicate DDC Training Phase I course as applied to the installed system. The instructor shall determine the level of the password to be issued to each student before each session. Upon completion of this course, students should be fully proficient in the operation of each system function.

-- End of Section --

SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002) National Standards for Total System Balance

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB TABES	(1998) Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVACTAB	(2002) HVAC Systems - Testing, Adjusting and Balancing

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G

Three copies of the TAB Schematic Drawings and Report Forms, no later than 21 days prior to the start of TAB field measurements.

SD-03 Product Data

TAB Related HVAC Submittals

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

TAB Procedures; G

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration

List of each instrument to be used during TAB, stating calibration requirements required or recommended by both the TAB Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

Systems Readiness Check

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; G

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; G

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-06 Test Reports

Design Review Report; G

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check; G

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Report; G

Three copies of the completed TAB Reports, no later than 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Verification Report; G

Three copies of the completed TAB Verification Report, no later than 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-07 Certificates

TAB Firm; G

Certification of the proposed TAB Firm's qualifications by either AABC, NEBB, or TABB (Testing, Adjusting and Balancing Bureau) to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC, NEBB or TABB against the proposed TAB Firm shall be described in detail.

TAB Specialist; G

Certification of the proposed TAB Specialist's qualifications by either AABC, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC, NEBB, or TABB against the proposed TAB Specialist shall be described in detail.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.	SMACNA's Procedures

SIMILAR TERMS

TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures.	Field Readiness Check & Prelim. Field Procedures

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.4.1 Water Flow TAB in the Absence of Flow Meters or Metered Balancing Devices

Where water meters, or metered balancing devices are not required to be provided, as indicated either by the plans and/or other specification sections, the water flow through each terminal unit, fan coil unit, reheat coil, unit heater, etc. shall be calculated by measuring the inlet and outlet water temperatures, and performing a heat balance with the air side, based on the manufacturers specified capacity. For unit heaters, or other terminal devices that are not connected to ducts and that are provided with an integral fan, the manufacturers airflow rates may be used in the calculations. Where ducts are connected, field measured air flows shall be used in the determination of the coil capacities. The supply water temperature for these balancing tests/measurements shall be at the highest nominal temperature for which the manufacturer publishes the coil heating capacities.

1.5 QUALIFICATIONS

1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including building systems commissioning. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of the mechanical subcontractor, and shall report to and be paid by the prime Contractor.

1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC,an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed under the direct guidance of the TAB Specialist. The TAB Specialist shall participate in the commissioning process specified in Section 15995 COMMISSIONING OF BUILDING SYSTEMS.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a Design Review Report individually listing each deficiency and the

corresponding proposed corrective action necessary for proper system operation. The design review report shall include calculations to support all assertions made regarding deficiencies found.

3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify all testing points and cross reference these points to the report forms and procedures.

3.4 TESTING, ADJUSTING, AND BALANCING

3.4.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components (such as exhaust fans, relief vents, etc.) and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

3.4.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness Check.

3.4.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the

appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall immediately provide a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation to the Contracting Officer.

3.4.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. The TAB Specialist shall update the original TAB report to reflect any changes or differences noted in the TAB verification report and submit the updated TAB report. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

3.4.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

3.4.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

3.4.7 Adjustment of Variable Speed Exhaust Fans

The TAB Specialist shall permanently and legibly identify in the O&M manual the relationship of fan pressure and flow of EF-1, with respect to the operating characterists of SF-1 under the following operating variations:

EF-1 fan speed as a function of SF-1 fan speed (EF-2 and -3 off).
EF-1 fan speed as a function of SF-1 fan speed (with EF-2 on)
EF-1 fan speed as a function of SF-1 fan speed (with EF-3 on)
EF-1 fan speed as a function of SF-1 fan speed (with both EF-2 and EF-3 on)

A schedule shall be provided and programmed into the DDC system reflecting as a minimum the above conditions. SF-1 shall modulate to maintain duct pressure as indicated in the sequence. EF-1 shall track SF-1 using real time feed forward algorythms programmed into the controller. TAB specialist shall adjust EF-1 fan speed to maintain building pressure between 0.0025 and 0.005 kPa under the above four conditions at all times.

In addition, a subset of the above four conditions shall be accounted for as part of the DDC programming as follows. Building pressure shall be maintained within the specified limits regardless of the position of the bypass damper at VAV-25.

-- End of Section --

SECTION 15995

COMMISSIONING OF BUILDING SYSTEMS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team; G

List of team members who will represent the Contractor in the pre-commissioning checks and functional performance testing, at least 2 weeks prior to the start of pre-commissioning checks. Proposed revisions to the list, shall be submitted prior to the start of the impacted work.

Tests; G

Detailed procedures for pre-commissioning checks and functional performance tests, at least 4 weeks prior to the start of pre-commissioning checks.

Pre-Commissioning Checks; G

Schedule for pre-commissioning checks and functional performance tests, at least 2 weeks prior to the start of pre-commissioning checks.

Owner's Project Requirements; G

Commissioning Plan; G

Training Verification; G

Commissioning Report; G

SD-06 Test Reports

Test Reports; G

Completed pre-commissioning checklists and functional performance test checklists organized by system and by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action

taken.

SD-07 Certificates

Qualifications; G

A letter no later than 14 days after the Notice to Proceed providing the name and Statement of Qualifications, including any certificates and a list of previous LEED certified projects worked on by the individual who will perform the duties specified herein for the Commissioning Authority.

SD-10 Operation and Maintenance Data

Re-commissioning Manual; G

Complete re-commissioning manual organized by system and by subsystem shall be indexed and submitted as one package to comply with LEED (Leadership in Energy and Environmental Design) "Additional Commissioning" credit requirements. Manuals shall feature all relevant engineering units in both English and Metric units.

a. As-built sequences of operations for all equipment, including time-of-day schedules and schedule frequency, and detailed point listings with ranges and initial setpoints

b. Ongoing operating instructions for all energy- and water-saving features and strategies

c. Functional performance tests results (benchmarks), blank test forms, and recommended schedule for ongoing benchmarking

d. Seasonal operational guidelines

e. Recommendations for recalibration frequency of sensors and actuators by type and use

f. Single line diagrams of each commissioned system

g. Troubleshooting table

h. Guidelines for continuous maintenance (operational requirements) and basis of operation

1.2 SEQUENCING AND SCHEDULING

The work described in this Section shall begin only after all work required in related Sections, including Section 15910 DIRECT DIGITAL CONTROL (DDC) SYSTEMS and Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS, has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Seismic details shall be in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

1.3 COMMISSIONING AUTHORITY

The Commissioning Authority shall be directly employed by the Prime Contractor and be independent of the mechanical, plumbing, and electrical contractors whose systems shall be commissioned. The Commissioning Authority shall be a member of the Commissioning team and shall participate in the pre-commissioning checks and the functional performance testing specified. In addition, the Commissioning Authority shall perform all duties associated with and required for the LEED "Additional Commissioning" credit, including prerequisite items and reviewing the contractor submittals relative to systems being commissioned, preparing the re-commissioning manual, and performing a post-occupancy review. The Commissioning Authority shall be regularly engaged in the commissioning of the type and complexity of systems specified in the Contract documents, and shall have served in a similar capacity for at least three LEED certified projects that obtained the "Additional Commissioning" credit.

1.3.1 Prerequisites

The Commissioning Authority shall be responsible for LEED Commissioning prerequisites to include documenting Fort Lewis Public Works' project requirements, reviewing the basis of design, creating a commissioning plan, verifying construction and installation of commissioned systems, documenting start-up and checkout results during construction, sampling verification of commissioned systems, preparing functional test procedures, compiling written verification of training for commissioned systems provided under other specification sections, reviewing Operations and Maintenance manuals for commissioned systems for completeness and applicability, and preparing a commissioning report.

1.3.1.1 Owner's Project Requirements

The Commissioning Authority shall document Fort Lewis Public Works’ project requirements. These requirements shall be utilized throughout the commissioning process to provide focus on the key success criteria. These requirements shall include HVAC, lighting, indoor environment, energy efficiency, siting, water and environmental responsiveness of the facility. This document shall also addresses the ideas, objectives and criteria that the owner considers important. Any criteria listed in the owner’s project requirements needs to be measurable, documentable and verifiable.

1.3.1.2 Basis of Design Review

The Commissioning Authority shall review the basis of design for how each of the owner’s project requirements has been met. Basis of design will include primary design assumptions such as occupancy, space and process requirements; applicable codes, policies and standard and load and climatic assumptions that influence design decisions.

1.3.1.3 Commissioning Plan

The Commissioning Authority shall develop a commissioning plan. The

commissioning plan shall include the following:

a. Brief overview of the commissioning process

b. List of all systems and assemblies included in the Commissioning Authority's scope of work

c. Identification of the Commissioning Team and its responsibilities

d. Description of the management, communication and reporting of the commissioning process

e. Overview of the commissioning process activities for the applicable pre-design, design, construction, and occupancy and operations phases, including development of the owner's project requirements, review of the basis of design, schematic design, construction documents and submittals, construction phase verification, functional performance test development and implementation, and 10-month warranty review.

f. List of the expected work products

g. List of key commissioning process milestones

1.3.1.4 Installation Verification

The Commissioning Authority shall accomplish ongoing site visits to verify that each commissioned system and assembly is being installed to achieve the owner's project requirements as detailed in the contract documents and manufacturer's instructions, and to verify that other building systems or assemblies are not compromising the performance of the feature. The Commissioning Authority shall accomplish this through verification of the contractor's completed construction checklists.

1.3.1.5 Start-up and Checkout

The contractor shall complete the start-up and initial checkout of all items listed in the contract documents. The start-up and checkout results shall be clearly documented according to the manufacturer's written instructions and the contract documents.

1.3.1.6 Sampling

The Commissioning Authority shall apply appropriate sampling techniques to verify that construction, startup and initial checkout of all commissioned systems and assemblies is successfully completed. For example, instead of checking 100% of the controls system, which is the contractor's responsibility, the Commissioning Authority shall utilize sampling techniques to complete an indepth periodic review of the control system installation, verifying that the components are calibrated; point-to-point checkouts are successful; and each control point is commanding, reporting and controlling according to the intended purpose. The Commissioning Authority shall use this ongoing sampling verification to identify systemic

issues early so they can be fixed and avoid rework at complete system checkout.

1.3.1.7 Tests

The Commissioning Authority shall prepare written, repeatable test procedures, specifically for each project, which are used to functionally test systems and assemblies. These tests shall be documented to clearly describe the individual systematic test procedures, the expected system response or acceptance criteria for each procedure, the actual response or findings, and any pertinent discussion. The test procedures shall be reviewed and accepted by the contractor, who may choose to implement the tests under the direction of the Commissioning Authority. After acceptance of the installation, startup and initial checkout (using the construction checklists), the following modes shall be tested. Test each sequence in the sequence of operations and other significant modes. Sequences and control strategies include start-up, shutdown, unoccupied and manual modes, modulation up and down the unit’s range of capacity, power failure, alarms, component staging and backup upon failure (unit and pump), interlocks with other equipment, and sensor and actuator calibrations. Test all larger equipment individually. Similar units that are numerous (e.g., fan coil units, variable air volume terminal units and exhaust fans) may require a specific sampling strategy. Heating equipment shall be tested during the winter, as appropriate to demonstrate performance under near-design conditions.

1.3.1.8 Training Verification

The Commissioning Authority shall assemble written verification that training was conducted for all commissioned features and systems. Training requirements are specified in the applicable specification sections for the system to be commissioned. The Commissioning Authority shall coordinate and ensure that facility staff has all the information needed to optimally operate, maintain and replace the commissioned features and systems. Training shall address the following:

a. General purpose of the system (design intent)

b. Use of the O&M manuals

c. Review of control drawings and schematics

d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms

e. Interactions with other systems, adjustments and optimizing methods for energy conservation, relevant health and safety issues

f. Adjustments and optimizing methods for energy conservation

g. Relevant health and safety issues

h. Special maintenance and replacement sources

i. Tenant interaction issues

j. Discussion of how the feature or system is environmentally responsive

1.3.1.9 Operations and Maintenance Manuals

The Commissioning Authority shall review the operations and maintenance (O&M) manuals for all commissioned systems and assemblies for completeness and applicability. The O&M data shall be bound in labeled binders liberally divided with tabs to provide efficient access. Manuals shall include: name, address and telephone number of the manufacturer or vendor and installing contractor; submittal data; and operations and maintenance instructions with the model and features for this site clearly marked. The manual shall only include data for equipment that is actually installed. Data requirements include: instructions for installation, maintenance, replacement, start-up, special maintenance and replacement sources, a parts list, a list of special tools, performance data, and warranty information. The manual shall also include a documentation package on as-built controls that includes a narrative for normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls setup and programming, troubleshooting, alarms, control drawings and schematics and final sequences of operation.

1.3.1.10 Commissioning Report

The commissioning report shall be presented to the owner within 30 days after occupancy. The report shall include a list of each commissioned system and assembly, as well as the disposition of the Commissioning Authority regarding the system’s or assembly’s compliance with the owner’s project requirements. Required components of the commissioning report shall include the following:

a. Description of the owner’s project requirements

b. Description of the project specifications

c. Verification of installation (construction checklist disposition)

d. Functional performance testing results and forms

e. O&M documentation evaluation

f. Training program evaluation

g. Value of the commissioning process

h. Outstanding issues

The written list of all outstanding commissioning issues and any testing that is scheduled for a later date, justified by seasonal conditions, must be included. A list of any compromises in the environmentally responsive

features must be provided. All outstanding environmentally responsive feature deficiencies must be corrected or listed in the commissioning report. All completed functional tests should be listed in an appendix to the commissioning report.

1.3.2 Contractor Submittal Review

The Commissioning Authority shall review the contractor’s standard submittals of commissioned systems and assemblies to verify that the feature being provided will meet the project requirements, particularly as it relates to environmentally responsive characteristics.

1.3.3 Re-commissioning Plan

The Commissioning Authority shall prepare the Re-commissioning Plan as specified in the SUBMITTALS paragraph.

1.3.4 Post-Occupancy Review

The Commissioning Authority shall return to the project site 10 months into the 12-month warranty period. The Commissioning Authority shall review current building operation with operating and maintenance personnel and address the condition of outstanding issues related to the Fort Lewis’s project requirements. Also, the Commissioning Authority shall interview operating and maintenance personnel to identify problems or concerns they have in operating the building as originally intended. The Commissioning Authority shall provide suggestions for improvements and record these changes in the systems manual. The Commissioning Authority shall identify problems that are covered under warranty or under the original construction contract. Finally, the Commissioning Authority shall assist operating and maintenance personnel in developing reports, documents and requests for services to remedy outstanding problems.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. In addition, the Government will be represented by a representative of the Contracting Officer and the Using Agency. The team members shall be as follows:

Designation	Function
Q	Contractor's Chief Quality Control Representative
M	Contractor's Mechanical or Plumbing Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative or

	Contractor's Barracks Mechanical Designer
O	Contracting Officer's Representative
U	Using Agency's Representative
A	Commissioning Authority

Appendices A and B are provided as a general checklist and have been prepared to best match the various equipment selected during the design of this project. Each checklist shown in Appendices A and B shall be reviewed and modified as necessary to reflect equipment actually installed during construction of the project. The commissioning team shall review the accuracy and applicability of each item in the checklist and revise as needed. Equipment shown in the checklist but not installed for the project shall be annotated as "NA". Likewise, equipment installed but not listed in the checklist shall be added or revised accordingly. A note as to why it was added or revised shall be inserted with the reviewer's initial. The commissioning team shall also add or modify to any of the equipment checklist items as required and/or specified by the equipment manufacturer. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date, unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members. The Contractor shall submit Test Reports as specified in the Submittals paragraph.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. Deficiencies discovered during these checks shall be corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

APPENDIX A

PRE-COMMISSIONING CHECKLISTS

Pre-commissioning checklist - Piping

For Each Hydronic and Non-Potable Water Piping System

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Piping complete.	___	___	X	___	X	___	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___	___
c. Piping flushed and cleaned.	___	___	X	___	X	___	___	___	___
d. Strainers cleaned.	___	___	X	___	X	___	___	___	___
e. Valves installed as required.	___	___	X	___	X	___	___	___	___
f. Piping insulated as required.	___	___	X	___	X	___	___	___	___
g. Thermometers and gauges installed as required.	___	___	X	___	X	___	___	___	___
h. Verify operation of valves.	___	___	X	___	___	___	___	___	___
i. Air vents installed as specified.	___	___	X	X	X	___	___	___	___
j. Flexible connectors installed as specified.	___	___	X	X	X	___	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	X	___	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. Hydrostatic test complete.	___	___	X	___	X	___	___	___	___
b. TAB operation complete.	___	___	X	___	___	___	___	___	___

Pre-commissioning Checklist - Ductwork

For Each Air Handler or Exhaust Fan:

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Ductwork complete.	___	___	X	___	X	___	___	___	___
b. As-built shop drawings submitted.	___	___	X	___	X	___	___	___	___
c. Deleted.									
d. Fire dampers, smoke dampers, and access doors installed as required.	___	___	X	___	X	___	___	___	___
e. Ductwork insulated as required.	___	___	X	___	X	___	___	___	___
f. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___	___
g. Verify open/closed status of dampers.	___	___	X	___	X	___	___	___	___
h. Verify smoke and fire damper operation.	___	___	X	___	___	___	___	___	___
i. Flexible connectors installed as specified	___	___	X	___	X	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. TAB operation complete.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Variable Volume Air Handling Unit

For each VAV Air Handling Unit :

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Vibration isolation devices installed.	___	___	X	X	X	___	___	___	___
b. Inspection and access doors are operable and sealed.	___	___	X	___	X	___	___	___	___
c. Casing undamaged.	___	___	X	X	X	___	___	___	___
d. Insulation undamaged.	___	___	X	X	X	___	___	___	___
e. Fan belt adjusted.	___	___	X	___	X	___	___	___	___
f. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___	___
Electrical									
a. Power available to unit disconnect.	___	___	___	X	X	___	___	___	___
b. Power available to unit control panel.	___	___	___	X	___	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___	___
Coils									
a. Hot water piping properly connected.	___	___	X	X	X	___	___	___	
b. Hot water piping pressure tested.	___	___	X	X	X	___	___	___	
c. Air vents installed on water coils with shutoff valves as specified.	___	___	X	X	X	___	___	___	
d. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___	
e. Chilled water piping properly connected.	___	___	X	X	X	___	___	___	
f. Chilled water piping pressure tested.	___	___	X	X	X	___	___	___	
g. Air vents installed on water coils with shutoff valves as specified.	___	___	X	X	X	___	___	___	

Pre-commissioning Checklist - Variable Volume Air Handling Unit

For each VAV Air Handling Unit :

Checklist Item	Q	M	E	T	C	D	O	U	A
Controls									
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___	___
e. Verify proper location, installation and calibration of duct static pressure sensor.	___	___	X	___	___	___	___	___	___
f. Fan air volume controller operable.	___	___	X	___	___	___	___	___	___
g. Air handler controls system operational.	___	___	X	___	___	___	___	___	__
Testing, Adjusting, and Balancing (TAB)									
a. Construction filters removed and replaced.	___	___	X	___	___	___	___	___	__
b. TAB report submitted.	___	___	X	___	X	___	___	___	___
c. TAB results within limits specified in Section 15990	___	___	X	___	X	___	___	___	___
d. TAB results for outside air intake within limits specified in Section 15990	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - VAV Terminal

For each VAV Terminal :

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. VAV terminal in place.	___	___	X	X	X	___	___	___	___
b. VAV terminal ducted.	___	___	X	X	X	___	___	___	___
c. VAV terminal connected to controls.	___	___	X	X	___	___	___	___	___
d. Reheat coil connected to hot water pipe.	___	___	X	___	X	___	___	___	__
e. Manufacturer's required maintenance clearance provided.	___	___	X	X	X	___	___	___	___
Controls									
a. Reheat VAV terminal controls set.	___	___	X	X	___	___	___	___	___
b. Reheat terminal/coil controls verified.	___	___	X	X	___	___	___	___	__
Testing, Adjusting, and Balancing (TAB)									
a. Verify terminal maximum air flow set.	___	___	X	___	___	___	___	___	___
b. Verify terminal minimum air flow set.	___	___	X	___	___	___	___	___	___
c. TAB operation complete.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Pumps

For each Pump (Hydronic and Plumbing Systems):

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Pumps grouted in place.	___	___	X	X	X	___	___	___	___
b. Pump vibration isolation devices functional.	___	___	X	X	X	___	___	___	___
c. Pump/motor coupling alignment verified.	___	___	X	X	X	___	___	___	__
d. Piping system installed.	___	___	X	X	X	___	___	___	___
e. Piping system pressure tested.	___	___	X	X	X	___	___	___	___
f. Pump not leaking.	___	___	X	X	X	___	___	___	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	___	X	X	X	___	___	___	__
Electrical									
a. Power available to pump disconnect.	___	___	___	X	X	___	___	___	___
b. Pump rotation verified.	___	___	___	X	X	___	___	___	___
c. Control system interlocks functional.	___	___	___	X	___	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. Pressure/temperature gauges installed.	___	___	X	___	X	___	___	___	___
b. Piping system cleaned.	___	___	X	X	X	___	___	___	___
c. Chemical water treatment complete.	___	___	X	X	X	___	___	___	___
d. Water balance complete.	___	___	X	___	X	___	___	___	___
e. Water balance with design maximum flow.	___	___	X	___	X	___	___	___	__
f. TAB Report submitted.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Pumps

For each Pump (Hydronic and Plumbing Systems):

Checklist Item	Q	M	E	T	C	D	O	U	A

Pre-commissioning Checklist - Duct Silencer

For each Duct Silencer

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Silencer installed in accordance to manufacturer recommendations.	___	___	X	___	___	___	___	___	___
b. Startup and checkout complete.	___	___	X	X	___	___	___	___	___
c. Manufacturer's insertion loss confirmed.	___	___	X	X	X	___	___	___	___

Pre-commissioning Checklist - Duct Silencer

For each Duct Silencer

Checklist Item	Q	M	E	T	C	D	O	U	A

Pre-commissioning Checklist - Heat Recovery Unit

For each Heat Recovery Unit

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Duct connections installed.	___	___	X	___	___	___	___	___	___
b. Duct connections are leak tight.	___	___	X	X	___	___	___	___	___
d. Manufacturer's required maintenance clearance provided.	___	___	X	___	___	___	___	___	___
e. Zone isolation valves tested.	___	___	X	X	X	___	___	___	___
Startup									
a. Startup and checkout complete.	___	___	X	X	___	___	___	___	___
Controls									
a. Air system balanced.	___	___	X	X	___	___	___	___	___
b. Controls operational.	___	___	X	X	___	___	___	___	___

Pre-commissioning Checklist - Heat Recovery Unit

For each Heat Recovery Unit

Checklist Item	Q	M	E	T	C	D	O	U	A

Pre-commissioning Checklist - Heat Exchanger

For each Heat Exchanger

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. HX pipe flex connections installed.	___	___	X	___	___	___	___	___	___
b. HX water piping installed.	___	___	X	___	___	___	___	___	___
c. HX water piping tested.	___	___	X	X	___	___	___	___	___
d. Manufacturer's required maintenance clearance provided.	___	___	X	___	___	___	___	___	___
e. Zone isolation valves tested.	___	___	X	X	X	___	___	___	___
Startup									
a. Recirc system cleaned and filled with water.	___	___	X	___	___	___	___	___	___
b. Safety/protection devices have been tested.	___	___	___	X	___	___	___	___	___
c. Startup and checkout complete.	___	___	X	X	___	___	___	___	___
Controls									
a. Control valves/actuators properly installed.	___	___	X	___	___	___	___	___	___
b. Control valves/actuators operable.	___	___	X	X	___	___	___	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___	___
d. Controls operational.	___	___	X	X	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. Construction filters removed and replaced.	___	___	X	___	___	___	___	___	__
b. TAB results within limits specified in									

Pre-commissioning Checklist - Heat Exchanger

For each Heat Exchanger

Checklist Item	Q	M	E	T	C	D	O	U	A
Section 15990	___	___	X	___	X	___	___	___	___
c. TAB Report submitted.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Heat Exchanger

For each Heat Exchanger

Checklist Item	Q	M	E	T	C	D	O	U	A

Pre-commissioning Checklist - Water-to-Air Heat Pump

For each Heat Pump

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. HP-X pipe flex connections installed.	___	___	X	___	___	___	___	___	___
b. HP-X water piping installed.	___	___	X	___	___	___	___	___	___
c. HP-X water piping tested.	___	___	X	X	___	___	___	___	___
d. Manufacturer's required maintenance clearance provided.	___	___	X	___	___	___	___	___	___
e. Zone isolation valves tested.	___	___	X	X	X	___	___	___	___
Startup									
a. Recirc system cleaned and filled with water.	___	___	X	___	___	___	___	___	___
b. Safety/protection devices have been tested.	___	___	___	X	___	___	___	___	___
c. Startup and checkout complete.	___	___	X	X	___	___	___	___	___
Electrical									
a. Verify that power disconnect is located within sight of the unit served.	___	___	___	X	___	___	___	___	___
b. Electrical back-up heating element tested.	___	___	___	X	___	___	___	___	___
c. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___	__
Controls									
a. Water pump interlock installed.	___	___	___	X	___	___	___	___	___
b. Water pump interlock tested.	___	___	___	X	___	___	___	___	___
c. Water heating system balanced.	___	___	X	X	___	___	___	___	___

Pre-commissioning Checklist - Water-to-Air Heat Pump

For each Heat Pump

Checklist Item	Q	M	E	T	C	D	O	U	A
d. Controls operational.	___	___	X	X	___	___	___	___	___

Pre-commissioning Checklist - Water-to-Water Heat Pump

For each Heat Pump

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. HP-x pipe flex connections installed.	___	___	X	___	___	___	___	___	___
b. HP-X water piping installed.	___	___	X	___	___	___	___	___	___
c. HP-X water piping tested.	___	___	X	X	___	___	___	___	___
d. Heat sink water piping installed.	___	___	X	___	___	___	___	___	___
e. Heat sink water piping tested.	___	___	X	X	X	___	___	___	___
f. Manufacturer's required maintenance clearance provided.	___	___	X	___	___	___	___	___	___
g. Zone isolation valves tested.	___	___	X	X	X	___	___	___	___
Startup									
a. Recirc system cleaned and filled with water.	___	___	X	___	___	___	___	___	___
b. Safety/protection devices have been tested.	___	___	___	X	___	___	___	___	___
c. Startup and checkout complete.	___	___	X	X	___	___	___	___	___
Electrical									
a. Verify that power disconnect is located within sight of the unit served.	___	___	___	X	___	___	___	___	___
Controls									
a. Water pump interlock installed.	___	___	___	X	___	___	___	___	___
b. Water pump interlock tested.	___	___	___	X	___	___	___	___	___
c. Water heating system balanced.	___	___	X	X	___	___	___	___	___
d. Controls operational.	___	___	X	X	___	___	___	___	___

Pre-commissioning Checklist - Radiant Floor

For Each Radiant Floor System:

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Water piping properly connected.	___	___	X	___	___	___	___	___	___
b. Water piping pressure tested.	___	___	X	___	___	___	___	___	___
b. Water piping flow balanced.	___	___	X	___	___	___	___	___	___
b. Water piping manifold valves accessible.	___	___	X	___	___	___	___	___	___
c. Manufacturer's required maintenance/ installation rqmts followed.	___	___	X	X	X	___	___	___	___
Controls									
a. Controls properly installed.	___	___	X	___	___	___	___	___	___
b. Manifold valves respond to transient conditions as expected.	___	___	X	X	___	___	___	___	___
c. Controls operable.	___	___	X	X	___	___	___	___	___
d. Verify proper location and installation of thermostat at each manifold.	___	___	X	___	___	___	___	___	___
e. Mixing valve has correct Cv.	___	___	X	___	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. TAB Report submitted.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Unit Heater

For Each Unit Heater:

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Power properly connected.	___	___	X	___	___	___	___	___	
b. Electrical element tested.	___	___	X	___	___	___	___	___	
c. Any damage to coil fins has been repaired.	___	___	X	___	X	___	___	___	__
d. Manufacturer's required maintenance/ operational clearance provided.	___	___	X	X	X	___	___	___	___
Electrical									
a. Power available to unit disconnect.	___	___	___	X	___	___	___	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___	___
Controls									
a. Controls properly installed.	___	___	X	___	___	___	___	___	___
b. Controls operable.	___	___	X	X	___	___	___	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. TAB Report submitted.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - Exhaust Fan

For Each Exhaust Fan:

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. Fan belt adjusted.	___	___	X	___	X	___	___	___	___
Electrical									
a. Power available to fan disconnect.	___	___	___	X	___	___	___	___	___
b. Proper motor rotation verified.	___	___	___	___	X	___	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___	___	___	___
Controls									
a. Control interlocks properly installed.	___	___	___	X	___	___	___	___	___
b. Control interlocks operable.	___	___	___	X	___	___	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___	___	___	___
Testing, Adjusting, and Balancing (TAB)									
a. TAB results within limits specified in Section 15990	___	___	X	___	X	___	___	___	___
b. TAB Report submitted.	___	___	X	___	X	___	___	___	___

Pre-commissioning Checklist - HVAC System Controls

For Each HVAC System:

Checklist Item	Q	M	E	T	C	D	O	U	A
Installation									
a. As-built shop drawings submitted.	___	___	X	X	___	___	___	___	___
b. Layout of control panel matches drawings.	___	___	X	X	___	___	___	___	__
c. Framed instructions mounted in or near control panel.	___	___	X	X	___	___	___	___	___
d. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___	___	___	___
e. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___	___	___	___
f. UMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___	___	___	___
g. Control wiring labeled at all terminations, splices, and junctions.	___	___	X	X	___	___	___	___	___
h. Shielded wiring used on electronic sensors.	___	___	X	X	___	___	___	___	__
Main Power									
a. 110 volt AC power available to panel.	___	___	___	X	___	___	___	___	___
Testing, Commissioning, and Balancing									
a. Testing, Commissioning, and Balancing Report submitted.	___	___	X	___	___	___	___	___	___

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test Checklist - Pumps

For Each Pump:

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.). ON_____ AUTO_____ OFF_____

a. Verify pressure drop across strainer:

Strainer inlet pressure _____ kPa
Strainer outlet pressure _____ kPa

b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

	DESIGN	SYSTEM TEST	ACTUAL
Pump inlet pressure (kPa gauge)	_____	_____	_____
Pump outlet pressure (kPa gauge)	_____	_____	_____

c. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa gauge)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

Functional Performance Test Checklist - Pumps

For Each Pump:

d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure (kPa gauge)	_____	_____
Pump outlet pressure	_____	_____
Pump flow rate (L/s)	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	
Voltage	_____		
Voltage to ground	_____	_____	_____

b. Minimum flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	
Voltage	_____		
Voltage to ground	_____	_____	_____

3. Unusual vibration, noise, etc.

_____

_____

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative

Functional Performance Test Checklist - Pumps

For Each Pump:

	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____
Commissioning Authority	_____

Functional Performance Test Checklist - VAV Terminals

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 10.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

a. VAV boxes with reheat:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 3 degrees C above ambient and measure maximum air flow. Turn thermostat to 3 degrees C below ambient and measure minimum air flow.

Maximum flow _____ L/s
Minimum flow _____ L/s

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ L/s
Minimum flow setting _____ L/s

Reheat coil operation range (full open to full closed) _____

b. Fan powered VAV boxes:

(1) Verify VAV box response to sensor call for heating via set point adjustment. Changes to be cooling setpoint to heating set point and return to cooling set point. _____ Verify cooling damper closes to minimum position, blower fan energizes according to sequence of operation, and upon further drop in space temperature, heating coil activation and deactivation. _____

(2) Check primary air damper maximum/minimum flow settings.

Maximum flow setting _____ L/s
Minimum flow setting _____ L/s

(3) Check blower fan flow. _____ L/s

(4) Verify free operation of fan backdraft damper (insure no primary air is being discharged through the recirculated air register).
_____

(5) Verify that no recirculated air is being induced when box is in full cooling. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Functional Performance Test Checklist - VAV Terminals

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Authority _____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Each VAV Air Handling Unit:

Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply and return fans operating mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____
_____

(4) VAV fan controller shall "soft-start" fan. _____

(5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the design static pressure Class shown.
_____

b. Occupied mode of operation.

(1) Outside air damper modulates to open upon start-up..
_____

(2) Exhaust air damper modulates with outside air intake damper according to sequence of operation.
_____

(3) Deleted.

(4) Hot water control valve modulating to maintain leaving air temperature set point. _____

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point.
_____

(6) Exhaust fan variable speed drive tracking supply fan SF-1 operation in accordance with sequence of operation.
_____

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Each VAV Air Handling Unit:

(2) Verify low limit space temperature is maintained as specified in sequence of operation. _____

e. The following shall be verified when the supply and return fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fans de-energize. _____

	Max cooling	Min cooling
Supply air volume (_____ L/s)	_____	_____
Supply air temp. (_____ degrees C)	_____	_____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Authority _____

Functional Performance Test Checklist - Heat Pump
For Each Heat Pump:

1. Functional Performance Test: Contractor shall demonstrate operation of system as per specifications including the following: Start building heating equipment to provide load for heat pump. Activate controls system boiler start sequence as follows.

a. Start hot water pump and establish water flow. Verify pump hot water proof-of-flow switch operation. _____

b. Verify control system energizes and deenergizes heat pump start sequence. _____

c. Verify heat pump HP-1 senses hot water temperature below set point and control system activates second heat pump (HP-2) start. _____

d. Shut off building heating equipment to remove load on hot water system. Verify heat pump shutdown sequence is initiated and accomplished after load is removed. _____

e. Verify low limit space temperature is maintained as specified in sequence of operation. _____

2. Verify heat pump inlet/outlet pressure reading, compare to Test and Balance (TAB) Report, heat pump design conditions, and heat pump manufacturer's performance data.

	DESIGN	SYSTEM TEST	ACTUAL
Heat pump inlet pressure (kPa gauge)	_____	_____	_____
Heat pump outlet pressure (kPa gauge)	_____	_____	_____
Heat pump flow rate (L/s)	_____	_____	_____

3. Record the following information:

Ambient temperature _____ degrees C
Entering hot water temperature _____ degrees C
Leaving hot water temperature _____ degrees C

4. Verify temperatures in item 3 are in accordance with the reset schedule. _____

5. Verify proper operation of safeties. _____

6. Unusual vibration, noise, etc.

_____

_____

7. Certification: We the undersigned have witnessed the above functional

Functional Performance Test Checklist - Heat Pump
For Each Heat Pump:
performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Chief Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____
Commissioning Authority	_____

Functional Performance Test Checklist - Unit Heaters

The Contracting Officer will select unit heaters to be spot-checked during the functional performance test. The number of terminals shall not exceed 10.

1. Functional Performance Test: Contractor shall demonstrate operation of selected unit heaters as per specifications including the following:

a. Verify unit heater response to room temperature set point adjustment. Changes to be heating set point to heating set point minus 10 degrees and return to heating set point. _____

b. Check blower fan speed. _____rpm

c. Check heating mode inlet air temperature. _____ degrees C

d. Check heating mode outlet air temperature. _____ degrees C

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Commissioning Authority _____

Functional Performance Test Checklist - Non-Potable Water Flushing System

For Non-Potable Water Flushing System

1. Functional Performance Test: Contractor shall verify operation of non-potable water flushing system as per specification including the following:

a. Verify water level in detention vault. Verify well pump operation when water level in the vault drops below and reaches the float low and high level settings.

_____

b. Verify pump operation when system pressure at the hydropneumatic tank drops below and reaches the high and low pressure setpoints.

_____

c. Verify system operation when flushing 6 water closets simultaneously. Repeat after a short period of approximately one minute.

_____

d. Verify DDC alarm when system pressure is below the low pressure setpoint and pumps are not operating.

_____

e. Verify domestic cold water make-up operation when water level in the vault drops below the float "low low" level setting.

_____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Chief Quality Control Representative	_____
Contractor's Plumbing Representative	_____
Contractor's Electrical Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____
Commissioning Authority	_____

Functional Performance Test Checklist - HVAC Controls

For Each HVAC System:

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 10.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following tests:

a. Verify that controller is maintaining the set point by manually measuring the controlled variable with a thermometer, sling psychrometer, inclined manometer, etc.

b. Verify sensor/controller combination by manually measuring the controlled medium. Take readings from control panel display and compare readings taken manually. Record all readings.

Sensor _____
Manual measurement _____
Panel reading value _____

c. Verify system stability by changing the controller set point as follows:

(1) Air temperature - 10 degrees F

(2) Water temperature - 10 degrees F

(3) Static pressure - 10 percent of set point

The control system shall be observed for 10 minutes after the change in set point. Instability or excessive hunting will be unacceptable.

d. Verify interlock with EF-1 such that feed forward control of EF-1 is confirmed to be following operation of SF-1.

e. Verify interlock of EF-2 with AHU-1, occupancy sensors, and other HVAC controls.

f. Verify interlock of EF-3 with HVAC controls.

g. Verify interlock with fire alarm control panel.

h. Confirm that manual shut-off at either Mech'l Platform or Assistant Chaplain's office functions as indicated, and sends a signal to the FACP.

i. Verify interlock with UMCS.

j. Confirm interlock of radiant floor with humidistat; confirm controls are adequately tracking dew point by measuring radiant floor water temperature response at control valves.

Functional Performance Test Checklist - HVAC Controls

For Each HVAC System:

k. Verify bypass functionality of VAV-25 as indicated.

l. Verify energization of EF-2 based on AHU-1 airflow volume as described in the sequence.

m. Verify AHU-1 VAV system interlock alarms: smoke, overpressure, low temp, high temp, and emergency shut-down via pushbutton (two locations).

n. Confirm operation of Mechanical and Electrical Room exhaust fans based on thermostat setpoints.

2. Verify that operation of control system conforms to that specified in the sequence of operation.

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

Commissioning Authority _____

Functional Performance Test Checklist - Energy Recovery System

For Each Energy Recovery System (HX-1, HX-2, HX-3): _____

1. Functional Performance Test: Contractor shall demonstrate operation of energy recovery system as per specifications including the following: Start equipment to provide energy source for recovery system.

a. Verify energy source is providing recoverable energy. _____

b. Verify recovery system senses available energy and activates. ____

c. Verify that recovery system deactivates when recoverable energy is no longer available. _____

2. Verify recovery system inlet/outlet readings, compare to design conditions and manufacturer's performance data.

	Design	Actual
Primary inlet temp (degrees C)	_____	_____
Primary outlet temp (degrees C)	_____	_____
Primary flow rate	_____	_____
Secondary inlet temp (degrees C)	_____	_____
Secondary outlet temp (degrees C)	_____	_____
Energy recovered (kW-hr)	_____	_____

3. Check and report unusual vibration, noise, etc.

_____

_____

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative_____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing , Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Energy Recovery System

For Each Energy Recovery System (HX-1, HX-2, HX-3): _____

Commissioning Authority _____

-- End of Section --

SECTION 16070

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CORPS OF ENGINEERS, HUNTSVILLE ENGINEERING AND SUPPORT CENTER (CEHNC)

TI 809-04	(1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 1570	(1995; Rev thru Feb 1999) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Feb 1999) Incandescent Lighting Fixtures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals without a designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting Fixtures in Buildings; G
Equipment Requirements; G

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Lighting Fixtures in Buildings; G
Equipment Requirements; G

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall

verify the capability of structural members to which bracing is attached for carrying the load from the brace.

Contractor Designed Bracing; G

Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.3 SYSTEM DESCRIPTION

1.3.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below. Structural and electrical requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.3.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Control Panels	Air Handling Units
Pumps with Motors	Switch Boards
Light Fixtures	Transformers
Cable Trays	Communications Racks

1.3.3 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. TI 809-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using TI 809-04 are based on strength design; therefore, the AISC LRFP specifications shall be used for the design. The bracing for the electrical equipment shall be developed by the Contractor.

1.3.4 Conduits Requiring No Special Seismic Restraints

Seismic restraints may be omitted from electrical conduit less than 64 mm trade size. All other interior conduit shall be seismically protected as specified.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand the seismic forces

specified in TI 809-04, Chapter 10. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

Transformers
Switch Boards
Cable Trays
Communications Racks
Emergency Lighting Battery System
Dimming Racks

1.4.2 Nonrigid or Flexibly-Mounted Equipment

Equipment shall be constructed and assembled to resist a horizontal lateral force of 1.25 times the operating weight of the equipment at the vertical center of gravity of the equipment.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

2.2 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

3.1 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe in accordance with Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.2 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.2.1 Pendant Fixtures

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

Pendant fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.2 Ceiling Attached Fixtures

3.2.2.1 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant system that is independent of the system used to support the suspended ceiling built in accordance with Section 09510 ACOUSTICAL CEILINGS. Seismic protection for the fixtures shall conform to the requirements of TI 809-04, Chapter 10. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.2.2.2 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant system that is independent of the system used to support the suspended ceiling built in accordance with Section 09510 ACOUSTICAL CEILINGS. Seismic protection for the fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.3 Assembly Mounted on Outlet Box

A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 100 mm boxes, plaster rings, and fixture studs.

3.2.4 Lateral Force

Structural requirements for light fixture bracing shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

-- End of Section --

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1	(2002) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C37.46	(2000) For High Voltage Expulsion and Current-Limiting Type Power Class Fuses and Fuse Disconnecting Switches
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C62.2	(1987) Guide For Application Of Gapped Silicon-Carbide Surge Arresters For Alternating Current Systems
ANSI C80.1	(1994) Rigid Steel Conduit - Zinc Coated

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 69 kV

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 48M	(2000) Gray Iron Castings (Metric)
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM B 3	(2001) Soft or Annealed Copper Wire
ASTM B 496	(2001) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C 478M	(2003) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(2000) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
ASTM D 923	(1997) Sampling Electrical Insulating Liquids

FM GLOBAL (FM)

FM P7825a	(2003) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C57.12.00	(2000) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C62.1	(1989; R 1994) Gapped Silicon-Carbide Surge Arresters for AC Power Circuits
IEEE C62.11	(1999) Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1KV)
IEEE Std 100	(2000) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V

IEEE Std 404	(2000) Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V Through 500 000 V
IEEE Std 48	(1996; R 2003) Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 592	(1990) Exposed Semiconducting Shields on High Voltage Cable Joints and Separable Insulated Connectors
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1	(2001) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA LA 1	(1992; R 1999) Surge Arresters
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 7	(1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1072	(2001; Rev thru Apr 2003) Medium-Voltage Power Cables
UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment

UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev thru May 2001) Wire Connectors for Use with Aluminum Conductors
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions. Seismic details shall conform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

a. Fungus Control

b. Altitude 100 m

c. Frequency 60Hz

d. Seismic Zone 3

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System; G

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Vaults and Manholes.

f. Surge arresters.

Profile Drawings; G

The Contractor shall submit for review and approval, profile drawings of the power and signal, duct and vault system shown on the plans. The drawings shall show locations and elevations of structures, relative to finished grade; provide for duct slope as specified in paragraph: Duct Lines: and provide for minimum and

maximum burial depth of vaults as indicated. The drawings shall be coordinated with other disciplines, and shall eliminate interference with "existing" or this "contract" utilities. Drawings shall be full size, complete with title blocks and other descriptive data, and numbered sequentially for insertion into the plan set. Drawings shall be prepared on CADD and shall include an electronic DXF file. Drawings shall be stamped by a registered Professional Engineer.

As-Built Drawings; G

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Nameplates;

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment;

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements;

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust,

calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests;

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing;

A proposed field test plan, 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests;

Six copies of the information described below in 215.9 by 279.4 mm (8-1/2 by 11 inch) binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Cable Installation;

Six copies of the information described below in 215.9 by 279.4 mm (8-1/2 by 11 inch) binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Material and Equipment;

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Joints; G

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required

to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications; G

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-10 Operation and Maintenance Data

Electrical Distribution System; G

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

1.6 OUTSIDE PLANT TELEPHONE

Outside Plant Telephone materials, equipment, and installation shall conform to the requirements of section 16711 TELEPHONE SYSTEM, OUTSIDE PLANT.

1.7 FIBER OPTIC CABLE SYSTEM

Fiber Optic Cable System materials, equipment, and installation shall conform to the requirements of section 16711 Telephone system, OUTSIDE PLANT.

1.8 CABLE TV

The Contractor shall coordinate with the local provider through the Contracting Officer. Cable and all connections will be done by the cable TV vendor.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in

accordance with IEEE C57.12.00. Nameplates shall indicate the number of liters and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 2 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 2 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch) from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTS AND COATINGS.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Medium-Voltage Cables

2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072

Cables shall be manufactured for use in duct applications.

2.4.1.2 Ratings

Cables shall be rated for a circuit voltage of 15 kV .

2.4.1.3 Conductor Material

Underground cables shall be soft drawn copper complying with ASTM B 3 and ASTM B 8 for regular concentric and compressed stranding or ASTM B 496 for compact stranding .

2.4.1.4 Insulation

Cable insulation shall be ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 8 and AEIC CS6. A 133 percent insulation level shall be used on 15 kV rated cables. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.4.1.5 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase. The shield tape shall be sized to meet IEEE C2 requirements for a ground fault availability of the following amperes.

Cable AWG/KCIL	Total Shield Area (CMIL)	30 Cycle Shield Fault Amps
2	7740	1335

2.4.1.6 Jackets

Cables shall be provided with a PVC jacket.

2.4.2 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.4.2.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8. Intermixing of copper and aluminum conductors is not permitted.

2.4.2.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.4.2.3 Jackets

Cables shall have an overall PVC outer jacket.

2.4.2.4 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592. Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used as substitutes for conventional permanent splices. External clamping points and test points shall be provided.

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2;

of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level.

2.5.4.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 315 mm long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type for duct lines between manholes and for other medium-voltage lines. Low-voltage lines run elsewhere may be direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.6.2.2 Direct Burial

UL 651 Schedule 40, or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 2 degrees C (35 degrees F), shall neither slump at a temperature of 150 degrees C (300 degrees F), nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48M , Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 69 MPa (10,000 psi) and a flexural strength of at least 34.5 MPa (5000 psi). Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.7.1 Engraved Covers

Engraved Covers shall be provided where indicated. Covers shall bear the insignia "POWER" or "SIGNAL" as applicable and the words "FORT LEWIS" in addition to the rendering. Covers shall be of the indicated size and shall be rated for vehicular loads in accordance with FS RR-F-621. Covers shall be cast iron complying with ASTM A48, class 30B; hardness 170-233 brinnell. Casting for covers shall be cope and drag system with the face of the casting being in the drag portion of the mold (poured face side down). Cope and drag shall align precisely to avoid excessive fining and misalignment. Casting shall be free of burrs, slag, air pockets, blow holes and flashing. Castings shall be squared and flat; excessive warpage shall not be acceptable. Casting sections shall align evenly with gap being no greater than 3mm. Alignment of design should be continuous where applicable. Welding or grinding on exposed surfaces of the castings shall not be acceptable. Mold for the covers shall be provided by the Contracting Officer.

2.8 TRANSFORMERS, SUBSTATIONS, AND SWITCHGEAR

Transformers, substations, and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.8.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.8.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching, oil-immersed, current-limiting, bayonet-type fuses, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stenciled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert.

2.8.1.2 Load-Break Switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment. Operation of switches shall be as follows:

ARRANGEMENT #	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION LINE A SW OPEN	LINE A SW CLOSE	LINE B SW OPEN	LINE B SW CLOSE	XFMR SW OPEN	XFMR SW CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X

ARRANGEMENT #	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION LINE A SW OPEN	LINE A SW CLOSE	LINE B SW OPEN	LINE B SW CLOSE	XFMR SW OPEN	XFMR SW CLOSE
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line B only	X			X		X
4	Transformer open and loop closed		X		X	X	
5	Transformer open and loop open	X		X		X	

2.8.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....kVA as indicated.

Impedance.....Manufacturer's Standard.

Temperature Rise.....65 degrees C.

High-voltage winding.....13800 volts.

High-voltage winding connections.....Delta.

Low-voltage winding.....As indicated.

Low-voltage winding connections.....Wye.

2.8.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.8.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations.

2.8.2 Sectionalizers

Sectionalizing terminals shall consist of a junction for each phase with way(s) for separable connectors. Junctions shall be mounted inside vaults for above ground hookstick operation. Brackets and attachment hardware for mounting of junctions shall be stainless steel and include parking stands. Junctions shall be loadbreak in 200 ampere connection systems.

2.9 METERING AND PROTECTIVE DEVICES

2.9.1 Fuses, Medium-Voltage, Including Current-Limiting

2.9.1.1 Construction

Units shall be suitable for outdoor use. Fuses shall have integral blown-fuse indicators. All ratings shall be clearly visible.

2.9.1.2 Ratings

Current-limiting power fuses shall have ratings in accordance with ANSI C37.46 and as follows:

Nominal voltage.....13.8KV.

Rated maximum voltage.....15KV.

Rated continuous current.....200A.

BIL.....95KV.

2.9.1.3 E-Rated, Current-Limiting Power Fuses

E-rated, current-limiting, power fuses shall conform to ANSI C37.46.

2.9.1.4 C-Rated, Current-Limiting Power Fuses

C-rated, current-limiting power fuses shall open in 1000 seconds at currents between 170 and 240 percent of the C rating.

2.10 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, ANSI C62.2, and

IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class, rated as shown. Arresters for use at elevations in excess of 1.8 km (6000 feet) above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor orcombination valve-metal-oxide varistor type.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 19 mm (3/4 inch) in diameter by 3.1 m (10 feet) in length. Sectional type rods may be used.

2.11.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.12 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 20 MPa compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

2.13 PADLOCKS

Padlocks shall comply with Section 08710 DOOR HARDWARE.

2.14 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825a as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.14.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.14.2 Fireproofing Tape

Fireproofing tape shall be at least 50 mm (2 inches) wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.14.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive, 0.254 mm (10 mil) thick, conforming to UL 510.

2.15 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 2 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 2 ppm shall be replaced.

2.16 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Transformers: Manufacturer's standard routine tests in accordance with IEEE C57.12.00.

f. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02300 EARTHWORK. Concrete work shall have minimum 20 MPa compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of

NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 6.4 mm (1/4 inch) less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 131 cubic centimeters (8 cubic inches) of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable

that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manila rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 10 degrees C (50 degrees F) temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall thrust pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors

shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.4 FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fire-proofed for their entire length within the manhole. Where cables and conductors have been lubricated to enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing. Fire-stops shall be installed in each conduit entering or leaving a manhole.

3.4.1 Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over exposed metallic items such as the cable ground wire, metallic outer covering, or armor to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints, shall be evened out with insulation putty. A flexible conformable polymeric elastomer fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of the first.

3.4.2 Sprayable Method

Manholes shall be power ventilated until coatings are dry and dewatered and the coatings are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable coatings shall be applied by spray, brush, or glove to a wet film thickness that reduces to the dry film thickness approved for fireproofing by FM P7825a. Application methods and necessary safety precautions shall be in accordance with the manufacturers instructions. After application, cable coatings shall be dry to the touch

in 1 to 2 hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

3.5 DUCT LINES

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 100 mm per 30 m. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 450 mm (18 inches) for ducts of less than 80 mm (3 inch) diameter, and 900 mm (36 inches) for ducts 80 mm (3 inches) or greater in diameter. Otherwise, long sweep bends having a minimum radius of 7.6 m shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 150 mm (6 inches) in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 1.2 m on

centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 150 mm vertically.

3.5.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 460 mm, but not less than 610 mm below finished grade and shall be installed with a minimum of 75 mm of earth around each duct, except that between adjacent electric power and communication ducts, 300 mm of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 75 mm layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least1 50 mm. The first 150 mm layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 75 to 150 mm layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.5.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 0.127 mm (5 mil) brightly colored plastic tape, not less than 75 mm (3 inches) in width and suitably inscribed at not more than 3 m (10 feet) on centers with a continuous metallic backing and a corrosion-resistant 0.0254 mm (1 mil) metallic foil core to permit easy location of the duct line, shall be placed approximately 300 mm below finished grade levels of such lines.

3.6 MANHOLES, HANDHOLES, AND PULLBOXES

3.6.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving.

The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 15 mm above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.6.2 Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.6.3 Communications Manholes

Communication Manholes shall conform to the requirements of Section 16711, TELEPHONE SYSTEM, OUTSIDE PLANT. Installation of communication manholes and ductbank shall conform to the requirements of this specification.

3.6.4 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.6.5 Pullboxes

Pullbox tops shall be flush with sidewalks or curbs or placed 15 mmabove surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.6.6 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 100 mm of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Pads shall be set on top of vaults. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with A-B-C, clockwise phase sequence. Primary taps shall be set at mid point.

3.7.1 Concrete Pads

3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 100 mm above finished paving or grade and sloped to drain. Edges of concrete pads shall have 20 mm chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum 20 MPa compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing

compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment. Padlocks shall be keyed as directed by the Contracting Officer.

3.8 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 3 m apart and with 1 strap not more than 300 mm from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.9 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 1.5 m outside of a building and 600 mm below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.10 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 4 connections shall be provided from a transformer to the ground ring. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.10.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 300 mm below finished grade.

b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed as shown. Ground ring

conductors shall be sized as shown.

c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 3 m (10 feet) rods spaced a minimum of 3 m apart .

3.10.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.10.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.10.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.10.5 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 50 mm above and 150 mm below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.10.6 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be

installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 600 mm.

3.11 FIELD TESTING

3.11.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.11.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.11.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Ground ring - 25 ohms.

3.11.4 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting

equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.11.5 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 304.8/(length of cable in meters)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.11.6 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

a. Insulation resistance test phase-to-ground.

b. Turns ratio test.

c. Correct phase sequence.

d. Correct operation of tap changer.

3.11.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings.

Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

a. Pad-mounted transformers

3.11.8 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.12 MANUFACTURER'S FIELD SERVICE

3.12.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.12.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.13 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C39.1	(1992) Requirements, Electrical Analog Indicating Instruments
ANSI C78.1	(1991; R 1998) For Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Single Ended Metal-Halide Lamps
ANSI C78.20	(1995) Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995; R 1998) Incandescent Lamps - PAR and R Shapes
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps

ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent Quad Tube Lamps
ANSI C82.1	(1997; R 1998) Electric Lamp Ballasts, Line Frequency Fluorescent Lamp Ballasts
ANSI C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 4059	(2000) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
ASTM D 709	(2001) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.20.1	(2002) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C57.13	(1993) Requirements for Instrument Transformer
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(2002) Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
NEMA FU 1	(2002) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000) Industrial Control and Systems: General Requirements

NEMA ICS 2	(2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts
NEMA ICS 3	(1993; R 2000) Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures
NEMA LE 4	(2001) Recessed Luminaires; Ceiling Compatibility
NEMA MG 1	(2003) Motors and Generators
NEMA MG 10	(2001) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA OS 1	(1996) Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA PB 1	(2000) Panelboards
NEMA PB 2	(2001) Deadfront Distribution Switchboards
NEMA RN 1	(1998) Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit
NEMA VE 1	(2002) Metal Cable Tray Systems
NEMA WD 1	(1999) General Color Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code
NFPA 70	(2005) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 18	Industrial, Scientific, and Medical Equipment

UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 1004	(1994; Rev thru Feb 2001) Electric Motors
UL 1022	(1998; Rev thru Aug 2001) Line Isolation Monitors
UL 1029	(1994; Rev thru Feb 2001) High-Intensity-Discharge Lamp Ballasts
UL 1047	(1995; Rev thru Jun 2000) Isolated Power Systems Equipment
UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors
UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 1660	(2000; Rev thru Jul 2002) Liquid-Tight Flexible Nonmetallic Conduit
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Feb 1998)High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 198L	(1995; Rev May 1995) D-C Fuses for Industrial Use
UL 20	(2000; Rev thru Jun 2003) General-Use Snap Switches

UL 360	(1996; Rev thru May 2003) Liquid-Tight Flexible Steel Conduits
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(2000; Rev thru Oct 2002) Splicing Wire Connectors
UL 486E	(1994; Rev thru May 2000) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(2002; Rev thru May 2003) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; Rev thru Oct 2002) Attachment Plugs and Receptacles
UL 5	(1996; Rev thru Oct 2001) Surface Metal Raceways and Fittings
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
UL 508	(1999; Rev thru Dec 2002) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; Rev thru Mar 1999) Fuseholders
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 514B	(1997; Rev thru Feb 2002) Fittings for Cable and Conduit
UL 514C	(1996; Rev thru Nov 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1999; Rev thru Feb 2003) Lampholders, Starters, and Starter Holders for Fluorescent Lamps

UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(2000; Rev thru Oct 2002) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 67	(1993; Rev thru Feb 2003) Panelboards
UL 797	(2000; Rev thru May 2003) Electrical Metallic Tubing -- Steel
UL 817	(2001) Cord Sets and Power-Supply Cords
UL 83	(1998; Rev thru Nov 2001) Thermoplastic-Insulated Wires and Cables
UL 845	(1995; Rev thru May 2000) Motor Control Centers
UL 854	(1999; Rev thru Nov 2002) Service-Entrance Cables
UL 869A	(1998) Reference Standard for Service Equipment
UL 891	(1998; Rev thru Feb 2003) Dead-Front Switchboards
UL 943	(1993; Rev thru Apr 2002) Ground-Fault Circuit-Interrupters
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL Elec Const Dir	(2003) Electrical Construction Equipment Directory

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The

front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 6.4 mm High Letters	Minimum 3.2 mm High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
	Other devices as shown on details
Equipment Enclosures	
Switchboards	
Motors	

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

1.2.7 Recessed Light Fixtures (RLF) Option

The Contractor has the option to substitute inch-pound (I-P) RLF to metric RLF. This option shall be coordinated with Section 09510 ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals without a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Interior Electrical Equipment; G.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission.

Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

a. Transformers.

b. Switchboard.

c. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.

d. Sway bracing for suspended luminaires.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures

shall be made at no additional cost to the Government.

SD-03 Product Data

Manufacturer's Catalog;

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists;

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures;

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

As-Built Drawings; G.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Test Reports; G.

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Field Test Plan; G.

A detailed description of the Contractor's proposed procedures for onsite test submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G.

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

h. Final position of controls and device settings.

SD-07 Certificates

Materials and Equipment;

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

1.5 SEISMIC REQUIREMENTS

Seismic details shallconform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be

stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83 except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.1.5 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.1.6 Cord Sets and Power-Supply Cords

UL 817.

2.2 CABLE TRAYS

Cable tray shall conform to NEMA VE 1, and shall be of nominal 100 depth. Cable trays shall be constructed of zinc-coated steel. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius. Radius of bends shall be 305 mm.

2.2.1 Ladder

Ladder-type cable trays shall be as shown. Rung spacing shall be on 230 mm maximum centers.

2.3 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of IEEE C62.41 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings shall be as indicated. Fuses shall not be used as surge suppression.

2.4 CIRCUIT BREAKERS

2.4.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489 Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

2.4.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.4.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.4.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150amperes.

2.4.2 SWD Circuit Breakers

Circuit breakers rated 15 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

2.4.3 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.4.4 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.5 CONDUIT AND TUBING

2.5.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.5.2 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.5.3 Intermediate Metal Conduit

UL 1242.

2.5.4 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.5.5 Rigid Metal Conduit

UL 6.

2.5.6 Rigid Plastic Conduit

NEMA TC 2, UL 651 and UL 651A.

2.5.7 Surface Metal Electrical Raceways and Fittings

UL 5.

2.6 CONDUIT AND DEVICE BOXES AND FITTINGS

2.6.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.6.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.6.3 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.6.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.6.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.7 Safety Disconnect Switch

UL 98.

2.8 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.9 CONNECTORS, WIRE PRESSURE

2.9.1 For Use With Copper Conductors

UL 486A.

2.10 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.10.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 19.1mm in diameter by 3.1 meter in length of the sectional type driven full length into the earth.

2.10.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.11 ENCLOSURES

NEMA ICS 6 or NEMA 250

2.11.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 0.0164 cubic meters shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.11.2 Circuit Breaker Enclosures

UL 489.

2.12 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

2.12.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992. All linear fluorescent, compact fluorescent, and high intensity discharge lamps shall be certified by the Washington Department of Ecology as a "non-hazardous waste" in the state of Washington. Contractor shall submit a letter from the Department of Ecology for all lamps to be used in the project.

a. Incandescent and tungsten halogen lamps shall be designed for 125 volt operation (except for low voltage lamps), shall be rated for minimum life of 2,000 hours, and shall have color temperature between 2,800 and 3,200 degrees Kelvin. Tungsten halogen lamps shall incorporate quartz capsule construction. Lamps shall comply with ANSI C78.20 and sections 238 and 270 of ANSI C78.21.

b. Fluorescent lamps in the Worship and Acitvity Centers shall have color temperature of 3,000 degrees Kelvin. All other fluorescent lamps shall have color temperature of 3,500 degrees Kelvin. . They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

(1) Linear fluorescent lamps, unless otherwise indicated, shall be 1219 mm long 32 watt T8, 265 mA, with minimum CRI of 80. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated as shown.

(2) Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 9 and 13 watt double tube lamps shall comply with ANSI C78.2B. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting

temperature shall be 0 degrees C for twin tube lampand -9 degrees C for double and triple twin tube lamps with internal starter.
(3) Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 10 degrees C . They shall deliver rated life when operatedas shown.

c. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -29 degrees C . Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355,ANSI C78.1375, and ANSI C78.1376.

2.12.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

a. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 25 degrees C above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 25 degrees C above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts at 60 Hz and maintain constant light output over a line voltage variation of $\pm$ 10%. Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain potting to secure PC board, provide lead strain relief, and

provide a moisture barrier.

(2) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 10 degrees C. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum $10 labor allowance per ballast.

(3) Dimming Ballasts shall comply with NEMA C82.11, UL 935, and NFPA 70, unless specified otherwise. Ballasts shall provide transient immunity as recommended by IEEE C62.41. Ballast dimming capability range shall be from 100 to 5 percent (minimum range) of light output, flicker free. Ballasts shall start lamp at any preset light output setting without first having to go to full light output. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to with they are connected.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
32W T8	rapid start linear	120 or 277 V	1	2.54
			2	1.44
			3	0.93
			4	0.73

b. High intensity discharge ballasts shall comply with UL 1029 and, if multiple supply types, with ANSI C82.4. Ballasts shall have minimum ballast factor of 0.9; high power factor; Class A sound rating; and maximum operating case temperature of 25 degrees C above ambient.

(1) Electronic high intensity discharge ballasts shall be constant wattage autotransformer type; shall have less than 10% ballast loss; shall have total harmonic distortion between 10 and 20%; and shall have a minimum starting temperature of -18 degrees C.

2.12.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting

supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 3 mm. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

a. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.

b. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Fixtures indicated as classified or rated for hazardous locations or special service shall be designed and independently tested for the environment in which they are installed. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off the lamp circuit if the lens is not in place.

c. Exit Signs

shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than 15 cd/m^2 measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than 8.6 cd/m^2 measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

2.12.4 Lampholders, Starters, and Starter Holders

UL 542

2.12.5 Lighting Controls

2.12.5.1 Enclosure

Relay panel (LRB - Lighting Relay Board) shall located as shown on the drawings and shall be a NEMA 1 enclosure with the following features:

a. Minimum of 16 gauge steel construction and completely painted with enamel type paint or equal.
b. Sized for numbers of relays and contactors indicated on the drawings.
c. The unit shall be wired to accept the maximum number of relays (6 relays) and contactors without requiring the addition of any automation cards, relay output modules or additional electronics. Any number of relays, up to the maximum size, may be installed in any one of the sizes listed.
d. Door shall be hinged with key lock and painted to match enclosure.

2.12.5.2 Lighting Control Relays

Each controlled circuit shall be connected through a single pole, single throw momentary-pulsed mechanically latching contactor rated at 20 amps, 120 VAC. Relay shall be:

a. Mechanically latching relay using a dual coil technology. Relays that use screw terminations for low voltage connections shall not be acceptable.
b. The load contacts shall be rated as follows: 20A, 125 VAC Tungsten; Ballast or Resistive; 0.5 HP @ 125 VAC.
c. All relays shall have a manual override.
d. All relays shall be factory wired for low voltage control and shall not have to be rewired in the field regardless of panel zoning requirements.

2.12.6 Lighting Control User Interface

Lighting relays shall be controlled through wall switch, located as shown.

2.12.7 Occupancy Sensors

Occupancy sensors shall be installed in rooms shown on plans. Occupancy sensor symbol indicates room to receive occupancy sensor. Contractor shall be responsible for coordinating type and appropriate location of occupancy sensor in each room with manufacturer to ensure proper operation of sensor.

The occupancy sensors shall be capable of detecting presence in an area to be controlled by use of dual technology sensing sensors that utilize passive infrared technology and a passive microphone with automatic gain control.

PIR sensing shall utilize a domed Fresnel lens providing a circular viewing pattern of 360 degrees by 56 degrees. The PIR shall initiate the on condition and both technologies shall be utilized to maintain the on condition. The sensor shall be capable of maintaining the on condition while a person is reading or writing while seated at a desk.

The sensors shall be ceiling mounted and not protrude more than 37.5 mm and shall blend in aesthetically with the ceiling unless otherwise shown on drawings.

Time delay range shall be adjustable from 15 seconds to 15 minutes.

Sensitivity adjustment shall range from off at "0" to maximum at "10."

Sensors shall have override switches located within room in which they are installed on the wall near other light switches in the room.

Where occupancy sensors are shown in rooms with partitions, sensor shall control only the lights on the side of the partition the sensor is located on.

Where indicated on plans, occupancy sensors shall be connected to mechanical exhaust fan that serves the room.

Sensors shall be UL and CSA listed products.

Sensors shall operate on 24 volts dc power, current draw is 20 milliamps.

2.13 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.13.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.13.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

Fuses, Class G, J, L and CC shall be in accordance with UL 198C.

2.13.3 Fuses, Class K, High-Interrupting-Capacity Type

UL 198D.

2.13.4 Fuses, Class H

UL 198B.

2.13.5 Fuses, Class R

UL 198E.

2.13.6 Fuses, Class T

UL 198H.

2.13.7 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.13.8 Fuses, D-C for Industrial Use

UL 198L.

2.13.9 Fuseholders

UL 512.

2.14 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.15 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral kilowatt, 373.0 kW and smaller shall conform to NEMA MG 1 and UL 1004for motors; NEMA MG 10 for energy management selection of polyphase motors. In addition to the standards listed above, motors shall be provided with efficiencies as specified in the table "MINIMUM NOMINAL EFFICIENCIES" below.

2.15.1 Rating

The kilowatt rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.15.2 Motor Efficiencies

All permanently wired polyphase motors of 746 W or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motor efficiencies indicated in the tables apply to general-purpose, single-speed, polyphase induction motors. Applications which require definite purpose, special purpose, special frame, or special mounted polyphase induction motors are excluded from these efficiency requirements. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

kW	1200 RPM	1800 RPM	3600 RPM
0.746	82.5	85.5	80.0
1.12	86.5	86.5	85.5

MINIMUM NOMINAL MOTOR EFFICIENCIES

1.49	87.5	86.5	86.5
2.24	89.5	89.5	86.5
3.73	89.5	89.5	89.5
5.60	91.7	91.0	89.5
7.46	91.7	91.7	90.2
11.2	92.4	93.0	91.0
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	93.6
44.8	95.0	95.0	94.1
56.9	95.0	95.0	94.5
74.6	95.0	95.4	94.5
93.3	95.4	95.4	95.0
112.0	95.8	95.8	95.4
149.0	95.4	95.8	95.4
187.0	95.4	96.2	95.8
224.0	95.4	95.0	95.4
261.0	94.5	95.4	95.0
298.0	94.1	95.8	95.0
336.0	94.5	95.4	95.4
373.0	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS

kW	1200 RPM	1800 RPM	3600 RPM
0.746	82.5	85.5	78.5
1.12	87.5	86.5	85.5
1.49	88.5	86.5	86.5
2.24	89.5	89.5	88.5
3.73	89.5	89.5	89.5
5.60	91.7	91.7	91.0
7.46	91.7	91.7	91.7
11.2	92.4	92.4	91.7
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	94.1
44.8	94.5	95.0	94.1
56.9	95.0	95.4	94.5
74.6	95.4	95.4	95.0
93.3	95.4	95.4	95.4
112.0	95.8	95.8	95.4
149.0	95.8	96.2	95.8
187.0	95.6	96.2	95.9
224.0	95.4	96.1	95.8
261.0	94.5	96.2	94.8
298.0	94.5	95.8	94.5
336.0	94.5	94.5	94.5
373.0	94.5	94.5	94.5

2.16 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

2.16.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

2.16.2 Motor Starters

Combination starters shall be provided with fusible switches.

2.16.3 Thermal-Overload Protection

Each motor of 93 W or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.16.4 Low-Voltage Motor Overload Relays

2.16.4.1 General

Thermal overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or motor controller, and shall be rated in accordance with the requirements of NFPA 70.

2.16.4.2 Construction

Manual reset type thermal relay shall be bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

2.16.4.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus 10 degrees C, an ambient temperature-compensated overload relay shall be provided.

2.16.5 Automatic Control Devices

2.16.5.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate kilowatt rating.

2.16.5.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

2.16.5.3 Manual/Automatic Selection

a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.

b. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

2.17 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.18 RECEPTACLES

2.18.1 Standard Grade

UL 498.

2.18.2 Ground Fault Interrupters

UL 943, Class A or B.

2.18.3 NEMA Standard Receptacle Configurations

NEMA WD 6.

a. Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt

15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R, 20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

2.19 Service Entrance Equipment

UL 869A.

2.20 SPLICE, CONDUCTOR

UL 486C.

2.21 POWER-SWITCHGEAR ASSEMBLIES INCLUDING SWITCHBOARDS

Assemblies shall be metal-enclosed, freestanding general-purpose type in accordance with NEMA PB 2, UL 891, and IEEE C37.20.1 and shall be installed to provide front access. Busses shall be copper. Assembly shall be approximately 2.3 meters high; arrangement of circuit breakers and other items specified shall be as indicated. The withstand rating and interrupting capacity of the switchboards and circuit breakers or fuses shall be based on the maximum fault current available.

2.21.1 Circuit Breakers

Circuit breakers shall be molded-case circuit breakers .

2.21.2 Auxiliary Equipment

2.21.2.1 Instruments

Instruments shall be long scale, 173 mm minimum, semiflush rectangular, indicating or digital switchboard type, mounted at eye level.

a. Ammeter, range 0 to 3000_ amperes, complete with selector switch having off position and positions to read each phase current.

b. Voltmeter, range 0 to _250_volts, complete with selector switch having off position and positions to read each phase to phase voltage.

2.22 SNAP SWITCHES

UL 20.

2.23 TAPES

2.23.1 Plastic Tape

UL 510.

2.23.2 Rubber Tape

UL 510.

2.24 ISOLATED POWER SYSTEM EQUIPMENT

UL 1047, with monitor UL 1022.

2.25 WATTHOUR METERS,

Watthour meters shall conform to ANSI C12.10. Provide watt-hour meter and socket corresponding to the ratios of the current transformers and transformer secondary voltage. Meters shall be selected for the building voltage, phase, four-wire wye system, three-element type with three current transformers. Meters shall be complete with a box mounted socket having automatic circuit closing bypass. Provide watt-hour meter with not less than four pointer-type kWh registers, provisions for pulse initiation, and a universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, with a 30-minute interval. Meter accuracy shall be within plus or minus one percent. The correct multiplier shall be provided on face of meter.

2.26 INSTRUMENT TRANSFORMERS

2.26.1 General

Instrument transformers shall comply with IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.26.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall be not less than 1.0 . Other thermal and mechanical ratings of current transformer and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accidental open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.26.2.1 Voltage Transformers

Voltage transformers shall have indicated ratios. Units shall have an accuracy class rating of 0.3. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

2.27 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.28 Liquid-Dielectrics

Liquid dielectrics for transformers, capacitors, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral oil or less flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall be certified by the manufacturer as having less than 2 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 2 ppm shall be replaced.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod,three_additional rods not less than 1.8 meters on centers, or if sectional type rods are used, two additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.2 Ground Bus

Ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 100 mm above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment. For raised floor equipment rooms in computer and data processing centers, a minimum of 4, one at each corner, multiple grounding systems shall be furnished. Connections shall be bolted type in lieu of thermoweld, so they can be changed as required by additions and/or alterations.

3.1.3 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following

specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, rigid plastic conduit,electrical metallic tubing,electrical nonmetallic tubing,intermediate metal conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 16 mm Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07840 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 150 mm away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor duct system shall be suitable for installation in wet locations.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 15 meters in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 45 meters in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 1.4 MPa (200 psi) tensile strength. Not less than 254 mm of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 150 mm above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.254 mm thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs and slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than 25.4 mm from the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Metallic conduits and tubing,and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 3 meters and within 900 mm of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded

threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.8 Exposed Risers

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed 3 meters.

3.2.1.9 Exposed Lengths of Conduit, Over 600 Volts

Exposed lengths of conduit containing power conductors operating at more than 600 volts shall have two red bands 50 mm wide spaced 200 mm apart painted near each coupling; the intervening space between the red bands shall be painted white, and on the white space the voltage shall be stenciled in black: 13,800 volts.

3.2.1.10 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 30 meters for 27 mm or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 27 mm size or larger shall not be less than ten times the nominal diameter.

3.2.2 Cable Trays

Cable trays shall be supported in accordance with the recommendations of the manufacturer but at no more than 1.8 meter intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. The Contractor shall submit the manufacturer's certification that the cable tray system meets all requirements of Article 318 of NFPA 70. The cable tray shall be installed and grounded in accordance with the provisions of Article 318 of NFPA 70. Data submitted by the Contractor shall demonstrate that the completed cable tray systems will comply with the specified requirements. Cable trays shall terminate 250 mm from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 103 mm (4 inch) rigid steel conduits with grounding bushings, extending 300 mm beyond each side of the partitions. The installation shall be sealed to preserve the smoke and fire rating of the partitions. Penetrations shall be firestopped in accordance with Section 07840 FIRESTOPPING.

3.2.3 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.3.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 30 meters long and of 277 volts more than 70 meters long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.3.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.3.3 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material

equivalent to the conductor insulation.

b. Greater Than 600 Volt: Cable splices shall be made in accordance with the cable manufacturer's recommendations and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.2.3.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).

b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 75 mm of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 1.2 meters above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls

shall be separated by a minimum horizontal distance of 600 mm. The total combined area of all box openings in fire rated walls shall not exceed 0.0645 square meters per 9.3 square meters. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 102 mm square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 2.4 mm wall thickness are acceptable. Large size boxes shall be NEMA 1 . . Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 38.1 mm (1-1/2 inches) into reinforced-concrete beams or more than 19.1 mm (3/4 inch) into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 25 mm long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 300 mm long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 6 mm from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be

mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 600 mm from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of impact-resistant plastic having rounded or beveled edgesand shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1.6 mm. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Clock Outlet

Clock outlet, for use in other than a wired clock system, shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top of the plate. Material and finish of the plate shall be as specified in paragraph DEVICE PLATES.

3.5.3 Floor Outlets

Floor outlets shall be fully adjustable and each outlet shall consist of a cast-metal body with threaded openings for conduits, adjustable ring, and cover plate with 15 mm or 20 mm threaded flush plug. Each telephone outlet shall consist of a horizontal cast housing with a receptacle as specified. Gaskets shall be used where necessary to ensure a watertight installation. Plugs with installation instructions shall be delivered to the Contracting Officer at the job site for capping outlets upon removal of service fittings.

3.5.4 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.4.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.5.4.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. .

3.5.5 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the type indicated in paragraph POWER SWITCHGEAR ASSEMBLIES INCLUDING SWITCHBOARDS with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper .

3.8.1 Panelboards

Panelboards shall be circuit breaker equipped . Wall mounted units in unfinished rooms shall be surface mounted. In finished rooms, units shall be recessed.

3.9 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination. Time-delay and non-time-delay options shall be as specified.

3.9.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H,

nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK1 shall have tested interrupting capacity not less than 200,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

3.9.3 Continuous Current Ratings (600 Amperes and Smaller)

Service entrance and feeder circuit fuses (600 amperes and smaller) shall be Class RK1, current-limiting, nontime-delaywith 200,000 amperes interrupting capacity.

3.9.4 Continuous Current Ratings (Greater than 600 Amperes)

Service entrance and feeder circuit fuses (greater than 600 amperes) shall be Class L, current-limiting, nontime-delay with 200,000 amperes interrupting capacity.

3.9.5 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

3.10 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 1.5 m beyond the building wall and 600 mm below finished grade, for interface with the exterior service lateral conduits . Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

3.11 MOTORS

Each motor shall conform to the kW and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual kilowatt (horsepower) ratings and other motor requirements necessary for the

applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.12 MOTOR CONTROL

Each motor or group of motors requiring a single control shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 93 W (1/8 hp) or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate kilowatt rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

3.12.1 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

3.12.2 Safety Controls

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit.

Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

3.13 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.14 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications. Lighting control system shall be in accordance with the requirements of Section 16900.

3.14.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

3.14.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved.

3.14.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

3.14.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable

fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance withUL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

3.14.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown. Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. Junction boxes shall be supported at four points.

3.14.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straights so that they hang plumb. 305 by 1219 mm fixtures shall be mounted along the grid rail as shown. Pendants, rods, or chains 1.2 meters or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 3.1 meters or as recommended by the manufacturer, whichever is less.

Suspended fixtures installed in seismic areas shall be installed in accordance with Section 16070 SEISMIC PROTECTION for the brace size.

3.14.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

3.14.4 Emergency Lighting, Uninterruptible Power System

Emergency power(UPS-Uninterrupted Power System) shall be provided by an AC System capable of powering a total connected load as indicated for a period

of 1-1/2 hours. Utility input supply to the system to be as indicated. The UPS shall operate in a Double Conversion mode providing conditioned, isolated power or Maintenance Bypass mode providing isolated power to the emergency lighting loads. The system shall be capable of powering any combination of fluorescent ballasts, H.I.D. lamps or other approved loads up to the total rating of the system. Emergency lighting inverters shall be self-testing/self diagnostic, automatically performing a minimum 30 second test and diagnostic routine at least every 30 days, and indicate failures and alarms. Status, test, and alarm information shall be stored in memory and retrievable from the unit display. Provide provisions for remote alarm indications and condition monitoring.

3.14.5 Components

The system shall consist of a rectifier, charger, battery, inverter, protective devices, static transfer switch, synchronizing and phase lock circuitry, and controls required to provide regulated, uninterrupted, conditioned power to emergency lighting loads.

a. System Charger: The system charger shall be the temperature compensated, constant voltage type providing constant current, float and equalize charging modes. The charger shall provide ample capacity to bring the system's battery bank from fully discharged to fully charged condition within acceptable UL 924 time standards.

b. Rectifier: The rectifier shall have sufficient capacity to supply full load current to the inverter while recharging a fully discharged battery.

c. Inverter: The inverter shall be an Insulated Gate Bipolar Transistor, Pulse Width Modulation design, capable of accepting the output of the boost and delivering AC power within specified limits to the critical load bus. The inverter shall be microprocessor controlled and shall include all necessary protective devices and control circuit. The inverter utilized by the system shall deliver single phase, sinusoidal emergency power free from high voltage surges or frequency drift. Inverter start up and shut down shall be accomplished by means of highly reliable electro-mechanical relay capable of transferring 100 percent of the system's rated capacity to the connected emergency load within one second of utility failure. Inverter output regulation shall be held to +10 percent -5 percent variance from nominal. Output frequency tolerance shall be +-2 percent. Full load harmonic distortion shall not exceed 10 percent. Inverter switching shall allow for the connection of normally-on, normally-off, or combination normally-on/normally-off, loads. Both charger and inverter assemblies shall employ fail-safe design and provide complete protection against thermal and current overloads. Inverter and charger operating efficiency shall not be less than 85 percent.

d. Batteries: Emergency power source shall be provided by sealed maintenance free lead calcium recombination batteries with 10 year expected life.

e. Static Transfer Switch: Static switch power rating shall be continuous duty power rated. Overload rating as shown: 10 minutes at 125%, 1 minute at 150%, 600 milliseconds at 1000%, and 100 millisecond at 1500%. The static switch shall use naturally commutated high speed Silicon Controlled Rectifier rated to conduct full load current continuously while in either line interactive or double conversion mode. An internally mounted static transfer switch and bypass circuit shall e provided as an integral part of UPS.

f. System Protection: Automatic system protection circuits shall include a low voltage battery disconnect, a brownout protection circuit and a 15 minute time delay in retransfer to standby operation.

g. Test Switch: A test switch shall be provided on the central display panel which will allow a manual 5 minute discharge/diagnostic test of the system at any time.

h. Transfer Mechanism: Mechanism shall utilize electromechanical transfer relays.

i. Miscellaneous Equipment: If the battery is taken out of service for maintenance via the disconnect switch, the UPS continues to function but provides no backup protection. If the UPS is taken out of service for maintenance, the UPS shall be provided with an internal maintenance bypass switch to enable a load transfer to the bypass.

The following equipment shall be provided with the system.

AC Output Current Display

AC Input Current Display

3.15 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 2 m or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.15.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.15.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

3.16 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.17 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTS AND COATINGS.

3.18 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.19 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer_7__ days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.19.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.19.2 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of

separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Ground ring - 25 ohms.

3.19.3 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

R in megohms = (rated voltage in kV + 1) x 304.8/(length of cable in meters)

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.19.3.1 Low Voltage Cable Tests

a. Continuity test.

b. Insulation resistance test.

3.19.4 Motor Tests

a. Phase rotation test to ensure proper directions.

b. Operation and sequence of reduced voltage starters.

c. High potential test on each winding to ground.

d. Insulation resistance of each winding to ground.

e. Vibration test.

f. Dielectric absorption test on motor .

3.19.5 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.19.5.1 Circuit Breakers, Molded Case

a. Insulation resistance test phase-to-phase, all combinations.

b. Insulation resistance test phase-to-ground, each phase.

c. Closed breaker contact resistance test.

d. Manual operation of the breaker.

3.20 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.21 FIELD SERVICE

3.21.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHSformat video tape of the entire training shall be submitted.

3.22 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION 16420

WORSHIP CENTER THEATRICAL LIGHTING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

1.2 GENERAL

The equipment described in the specification is based on products from the listed manufacturers, and will be used as the basis of comparison for all alternate proposals. This specification is to provide for the correct furnishing, installation, testing and placing in operation of the necessary equipment for a complete Stage Lighting and Control installation.

The Contractor, as part of the work of this section, shall provide all labor, materials, and testing and make all necessary arrangements as required by the specification. The Contractor is responsible to ensure that a complete working system is handed over to the Government.

The Contractor shall be responsible for the following:

a. Providing and installing all theatrical lighting instruments and their ancillary parts as specified herein.

b. Each theatrical lighting fixture shall be lamped and, where applicable, bench focused to a flat, even field.

c. Hanging and focusing all theatrical lighting instruments to an initial working lighting plot designed by the Contractor.

d. Provide and install all low voltage control face panels, control electronics and dimmer modules.

e. Provide and install all dimmer racks, control electronics housings, connector strips, wall boxes, and/or floor pockets.

f. Provide and install all hangers and other hardware required for installing the connector strips, if any.

g. Provide a factory-trained technician for system commissioning, including inspection, testing and programming for the complete project.

h. Test all circuits for proper wiring, polarity, connection to proper dimmer, and inspect for correct labeling.

i. Provide shop drawings, As-Built drawings, owner training, and operation manuals.

j. Providing, installing and terminating all 120V distribution circuits and all 120/208V feeder circuits for the theatrical lighting system.

k. Terminating all 120V distribution circuits onto the dimmers.

l. Termination of power distribution cable.

m. Provide and install all low voltage control cabling (termination to be done by Contractor).

n. Provision and installation of all conduits, junction boxes, electrical wireways, and cable trays required for the lighting and control distribution systems, including back boxes for the preset wall stations and low-voltage control plug-ins.

o. Clean all racks, panels, and boxes of dirt, dust, and debris.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Detail drawings shall consist of illustrations, schedules, performance charts, instructions, brochures, diagrams, catalog cuts, manufacturer's data, materials and equipment lists, and operational and general maintenance instructions. Detail drawings shall be submitted for the overall system and for each major component. Drawings shall illustrate how each item of equipment has been coordinated and will function properly in the system. Detail drawings shall include an overall system schematic indicating relationship of intercommunication units on one diagram and showing power source, system controls, impedance matches, plus number, size, and maximum lengths of interconnecting wires and indicate clearances required for maintenance and operation. Calculations for power requirements of equipment shall be provided.

Additionally, the submittal shall include the following items:

a. Shop drawings indicating exact dimensions, details, and configuration for:

1. Rigging diagrams for fixtures mounted to glu-lam beams as

shown on plans showing hardware selection and sizing.

b. Proposed schedule for dimming and list of presets available at the Activity and Worship Center Master Control Stations (Shown as LCSW and LCSA on drawings). Schedule shall show lighting levels of all dimming circuits for each preset. Presets shall take into consideration the various functions that may occur in the Worship and Activity Centers.

c. Proposed schedule for dimming and list of presets available at Activity and Worship Center Recall Stations (Shown as WCM and ACM on drawings). Schedule shall show lighting levels of all dimming circuits for each preset.

SD-03 Product Data

Manufacturer's Catalog;

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists;

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures;

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

As-Built Drawings; G.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built

drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Field Test Plan; G.

A detailed description of the Contractor's proposed procedures for onsite test submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G.

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

h. Final position of controls and device settings.Test plan

SD-07 Certificates

Materials and Equipment;

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment

conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

1.5 SEISMIC REQUIREMENTS

Seismic details shall conform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

Manufacturers (Design Basis): The following manufacturer's products have been used to set the standard for minimum conformance to this specification. Where specific model information is given regarding materials, an approved equal is allowable.

a. Lehigh Electric Products Company - Theatrical Dimming and Control Equipment

b. Electronic Theatre Controls - Theatrical Lighting Fixtures

2.1 DIMMING EQUIPMENT:

DIMMER RACK: Modular, freestanding cabinet with a welded steel frame, removable panels, and a locking door over the dimmers. Dimensions shall not exceed 490mm wide by 525mm deep and 2040mm high. Finish shall be textured powdercoated paint.

a. Main and neutral lugs: Rated to 225 amps per phase for 120/208V,

60Hz, 3 phase, 4 wire operation. Visible indicator lights for each phase.

b. Safety Approvals: UL and C-UL Listed Dead Front Switchboard to 10,000 AIC with optional ratings to 100,000 AIC.

c. Dimmer modules to mount on trays with guide rails to align the dimmer during insertion. Cabinet shipped without the dimmers installed.

d. Factory wired dimmer input power and control wiring. Load lugs suitable for #6ga wire standard, #2ga wire optional, provided for contractor load wire terminations.

e. Cooling: High capacity ball bearing fan operating only when any control signal is active to maintain proper operating temperatures. Suitable for room ambient up to 40oC. Each dimmer module to be cooled by incoming room ambient air. Drawing air through multiple dimmer modules is not acceptable. Provide an overheat indicator light on each dimmer module.

f. Air filter: Electrostatic air filter provided on a full height lockable door. Filter is removable for easy cleaning.

Dimmer Rack Electronics:

a. System Control Module (SCM) to include a DC power supply, a dimmer firing card, and a System Control card. LEDs indicate the active power phases, inter-rack control link, PC link, DMXA link, DMXB link, Ethernet activity & Ethernet status.

b. SCM to include a 16 bit digital processor to control 512 dimmers and simultaneously accept 2 optically isolated (2500V RMS minimum) DMX512 inputs and a Collage control input. Dimmers may be patched to multiple control inputs and programmable control precedence shall set the order and combinations of control links for each dimmer. System electronics to be completely digital, with no digital to analog demultiplexing circuitry or analog ramping schemes.

c. System configuration, back-up cues, user programmable data and operating data to be stored in a non-volatile Flash memory. Off-line storage shall be on a 3-1/2 inch floppy disk drive attached to the SCM. SCM shall include a RS232 PC port allowing a computer to interface to the SCM for configuration, operation and off-line storage.

d. Ethernet expansion option: Provide an Ethernet link option allowing connection for remote monitoring, programming and subsystem networking. All Ethernet monitoring and control can be done from a compatible console or PC.

e. Control system to support multiple Rack Control Stations (RCS) mounted at the dimmer cabinet, as a remote station, or as a portable controller. RCS to include a 4 line by 20 character LCD display plus 26 keys for system programming and control. Keys include 4 cursor control, 0 thru 9, Clear, Enter, Capture, Config, Edit, Backup, Set, And/Thru,

At/Dimr, Next/Fl, Focus, and Status. Keypad to be enclosed membrane type with audible feedback switches and silk-screened legends.

f. The following functions to be programmable from an RCS or PC:

(1) Store 99 back up cues plus blackout with individual fade times to 999 seconds. Cues to be recorded using the current dimmer levels of the combined active links.

(2) Preview and edit stored cues and modify channel levels and fade times. Cues may be edited live or blind.

(3) Config. mode to program dimmer to link assignments:

(a) Dimmer mode assigns dimmers to DMXA, DMXB, or Collage links; and backup mode programming. 5 digit alphanumeric ID assignable to each dimmer.

(b) Floppy disk drive mode records the SCM data to the floppy disk.

g. Program system response to lost control link:

(1) Hold current levels for a programmed time interval or until another cue is manually selected.

(2) Automatically recall a preselected backup cue.

(3) Automatically transfer to another active control link.

h. Recall backup cues using one of three modes:

(1) Recall Cue: Activate cues 0 thru 99 using RCS or PC. Cues may be recalled via remote recall stations. Master raise/lower control modifies active backup cue.

(2) Backup Off: Returns rack control to the normal link.

(3) Console Mode: SCM sequences through backup cues using programmed fade times. RCS display lists Active Cue, Next Cue, and Fade Time. Next key cross fades from active to next cue and display increments cues. Active Cue, Next Cue, and Fade Time may be changed at any time.

i. Dimmer focus check.

j. Program dimmers to operate in dim or non-dim mode.

k. Program time clock events via the PC to activate back-up cues.

l. Program rack partitioning on a dimmer by dimmer basis to assign each dimmer to a control configuration using one or more control link inputs.

m. System diagnostic routine.

n. Basic Collage Architectural Controls (standard):

(1) Dimmer to channel to room patch for 512 dimmers on 128 channels.

(2) Up to 48 control stations.

(3) 16 rooms with 24 presets plus off per room with programmable room, channel, and preset names.

(4) Astronomical time clock control with 128 events including macro control.

(5) Programmable remote station switch control functions: presets, macros, station lock, preset master, and room combine control.

r. Dimmers controlled by the SCM to meet or exceed the following:

(1) Dimmer output regulated for each dimmer for incoming line voltage fluctuations and adjusted for both RMS voltage changes and deformations of the AC waveform. The maximum programmed dimmer output cannot exceed the line voltage less the dimmer voltage drop.

(2) Response time to incoming line voltage changes not to exceed 16ms.

(3) Dimmers set to the same level operate within +/-1V of each other.

(4) Programmable dimmer or non-dim operation.

(5) Program minimum and maximum control levels on a dimmer by dimmer basis.

(6) Control curve options: 8 standard curves, one user programmable curve and programmable non-dim trigger point.

(7) Programmable voltage boost to allow for long cable drops.

Dimmers: Modular steel housing with black powder coated finish, black anodized extruded aluminum heat sink, front ventilation slots, and a handle. Plug-in modules shall have a floating power, load and control assembly for positive alignment with mating receptacles. Control and power connections assure no arcing during dimmer insertion or removal. Dimmer modules of the samerating shall be interchangeable within the rack without modification.

a. Dimmer ratings: 2.4KW as scheduled.

b. Overload protection: Properly rated fully magnetic circuit breaker, UL Listed under UL489 as a branch circuit protector with a minimum rating of 10,000 AIC mounted in module. Circuit breaker rated for switching duty.

c. SCR: Back to back silicon controlled rectifiers (SCR), mounted on an exposed ceramic substrate in an electrically isolated assembly complete with opto-isolator, trigger SCR and steering bridge. There shall be a minimum of 4000 volts isolation between AC and control lines. The SCR shall carry the full rated load of the dimmer indefinitely. Hot patching loads within the dimmer rating shall not damage the dimmer.

d. Temperature sensing: Monitor the internal dimmer module temperature and de-energize the module if overheated. Dimmer module LED and Rack Control Station indicate an overheat condition. Systems not monitoring individual dimmer modules and only the rack temperature are not acceptable.

e. Filtering: Include a toroidal choke to limit the current rise time to a minimum of 350 microseconds (standard) as measured from 10% to 90% of the output waveform at maximum load. Filter to limit interference to audio systems, reduce lamp filament noise, and the introduction of RF on the AC line. Optional rise time models: HR (500 microsecond dual 2.4kw dimmer) and EHR (800 microsecond single 2.4kw dimmer)

f. Dimmer performance:

(1) Ambient temperature range of 0o to 40oC.

(2) Line voltage range from 90 to 140 volts.

(3) Dimmer output to be regulated over the entire voltage range, adjusting for both RMS variations and deformations in the incoming AC line. The output voltage to be maintained to within +/- 1V of the desired setting, as long as the setting is below the level of the line minus the dimmer loss. The regulation to compensate on a dimmer-by-dimmer basis.

(4) Use digital signal processing to precisely control each dimmer, maintaining both the dimmer curve and the line voltage regulation.

(5) Symmetrical alternating current output, eliminating any DC component to the load.

(6) No interaction between any dimmers in the system.

(7) Dimmer turn-on/turn-off time not to exceed 1/10 second.

(8) 97% minimum dimmer efficiency at any load or voltage setting.

(9) UL and C-UL Recognized.

Provide:

(1) - Dimmer Rack with SCM Advanced Electronics

(12) - 2.4kw dual incandescent dimmer modules (350 microseconds)
(15) - 2.4kw single fluorescent dimmer modules (350 microseconds)

2.2 CONTROL SYSTEM

2.2.1 Master Control Station (Shown as LCSW and LCSA on drawings)

Master station shall be recessed in the wall as shown on drawings and provide programmable presets with individual channel control. The control system shall have a digital output requiring two shielded pair plus 3-#14 wires for up to 16 stations. Station faceplate shall be high impact polycarbonate with silscreened legends and no visible mounting screws. Master Control Station shall be installed in seven gang, 89mm deep masonry backbox. The station shall provide the following functions:

a. Program 24 presets plus Full for 24 control channels with no external controls required to set or store presets. To provide 24 control channels, the 12 channel station includes a channel page function to store the 12 channels in two pages for a total of 24 channels. A channel page switch shall select the pages with LEDs indicating the active page.

b. Manual preset to fade all channels to 75% over a 5 second fade. The channel controllers provide direct control of the the individual channels.

c. 1 line by 16 character backlit, supertwist LCD display to provide preset names, fade times, and program menus. The station shall include the following control buttons:

1. Full: Instantly brings selected channels to 100%.
2. Off: Fades all channels to blackout over 10 seconds.
3. Preview: Bargraphs display channel levels for previewed preset.
4. Enter: Activates preset shown in display.
5. Scroll: Scrolls preset names and control menus in display.
6. Store: Records the channels levels to a preset.

d. Individual channel raise/lower buttons to set channel levels from 0 to 100% in preview, programming, and manual control modes. Each channel includes a 10 segment bargraph display which tracks the channel level. A channel's level may be changed without affecting other channels. Pressing Store records the new channel levels in memory.

e. Proportional master to raise or lower all channels in an active preset. Master modifications are temporary and do not change the preset memory.

f. Programmable fade rate for each preset from 0 seconds to 60 minutes. An active fade may be accelerated by repressing the Enter button. The LCD display indicates the remaining fade time.

g. Preview a preset blind and permanently modify the channel levels and fade time without affecting active lighting levels.

h. Select preset names from the station library or create custom

names.

i. Copy any preset to another preset.

j. Lock function to lock the station memory and/or the entrance stations using an access code.

k. Program Dim/Non-dim control for each channel.

l. Program On/Off level of each channel for Full mode.

m. Battery back-up to retain the station memory for up to 10 years if power is lost. Station returns to the last preset used when power is restored.

n. Provide: As shown on drawings.

2.2.2 Recall Stations (Shown as WCM and ACM on drawings)

Recall stations to be Collage Plus CPE412R/L or approved equal. Stations shall recall 12 presets, master raise and lower buttons, plus off. Provide at locations as shown on the drawings. Recall stations shall be installed in two gang 89mm deep masonry backbox.

2.2.3 Room Combination Station (Shown as PAR on drawings)

Provide a partition control station for combining master and recall stations in the Worship Area and Activity Center. Station to have close/combine switches with LED status indicators. When in closed Mode, stations in each area will have individual control. When in open Mode, the two areas will be combined and control can be from any station. Room Combination Station shall be installed in single gang, 89mm deep masonry backbox. Provide at location as shown on the drawings.

2.2.4 Room Entrance Stations (Shown as WCE and ACE on drawings)

Entrance Station shall be Collage Plus CPE403 with preset 1, full and off control. Room Entrance Station shall be installed in single gang 89mm deep masonry backbox. Provide at locations as shown on the drawings.

2.2.5 Infrared Wireless Transmitter and Receiver (shown as WIR and AIR on drawings)

Wireless transmitter to activate presets 1 through 12 and off. Master raise/lower control function to proportionately override the active preset levels. 15 pushbuttons with silkscreened legends to activate the system presets and master control function. Transmitter shall be compact, battery powered handheld controller constructed of high impact plastic. Controller shall transmit an infrared signal to a wall mounted receiver. Transmitter to have a 15 240mm operating range.

Receiver station shall be single gang with a high impact plastic faceplate. Station shall mount in a single gang, 89mm deep back box. Receiver station shall include an infrared receiver port and LED to indicate signal reception.

Provide at locations as shown on the drawings.

2.3 LUMINAIRES AND DISTRIBUTION EQUIPMENT, GENERAL

a. Metal Parts: Free from burrs and sharp corners and edges.

b. Sheet Metal Components: Steel, formed and supported to prevent warping and sagging.

c. Luminaire Doors and Other Internal Access Provisions: Smooth operating and free from light leakage under operating conditions. Lamp doors are arranged to permit relamping without use of tools.

d. Luminaire Pigtails: Factory wired, 914mm long, 3-wire cord and plug connector assembly with cord encased in woven fiberglass or silicone tubing.

e. Plug Connectors: 1-pole, 3-wire, 20-ampere stagepin type.

f. Pipe Clamps: Malleable iron, suitable for clamping luminaire or items to pipe from 3/4- to 2-inch outside diameter. Arrange luminaire clamps for horizontal rotation of the yoke for aiming and equipped with a T-bolt to lock alignment.

g. Safety Cables: Heavy duty, flexible steel, 30-inch nominal length, with spring clip at one end and steel ring at other.

h. Lamp Sockets: Relampable without disturbing focus adjustment or alignment.

i. Luminaire Ventilation Openings: Baffled against light leaks.

j. Luminaire Operating Controls and Handles: Thermally insulated.

k. Lenses: Borosilicate glass in silicone mountings.

l. Color Filter Frame Holder: Attached to front of luminaire

m. Fixture Yoke: Rigid metal, arranged for vertical aiming of unit. Equipped with a T-bolt or hand screw to lock alignment.

2.4 DISTRIBUTION EQUIPMENT

All Distribution Equipment shall be listed and labeled by Underwriters Laboratories.

Recessed Mount Outlet Boxes:

a. Assembly shall consist of a 16-gauge, galvanized housing designed for recessed mounting in the wall and shall be provided with a 16-gauge steel oversized face plate.

b. The box may have up to six 15, 20, 30, 50, 60 and 60 Amp receptacles/connectors, flush mounted or pigtails, as required.

c. The box shall be completely pre-wired at the factory, with ground lugs installed.

d. Finish shall be white gloss enamel.

Stage Pin Extension Cables:

a. Cables shall be labeled for length using appropriately sized selfadhesive numbers 3 inches from both connector ends covered by clear heat shrink tubing.

b. Cables shall be supplied with one (1) appropriately sized Velcro cable tie.

c. Cables and connectors shall be white.

d. Cables shall be constructed using 12/3 SO-W cable.

e. Cables shall be constructed with one (1) 20A 2P&G Female connector and one (1) 2P&G Male plug, both rated for 120VAC, when loaded at 20A.

2.5 LUMINAIRES

Luminaires shall be UL / cUL listed and labeled for use with the specified wattage lamp.

Standard Features: Provide the following in white with each luminaire: yoke, pipe clamp, safety cable, wiring set with stage pin plug, and color filter holder.

Ellipsoidal Zoom Spotlights (TI1 AND TI2):

a. General

(1) The instrument shall be a Source Four Zoom ellipsoidal spotlight as manufactured by Electronic Theatre Controls, Inc., or approved equal.

b. Physical

(1) The unit shall be constructed of rugged, die cast aluminum and extruded aluminum, free of burrs and pits, finished in white, high temperature epoxy paint. Tools shall not be required for either lamp alignment. A Phillips head screwdriver shall be required for cleaning the reflector.

(2) The following shall be provided:

(a) 15-30 degrees or 25-50 degrees field angle range, as shown on drawings

(b) Bind free one hand zoom angle/focus adjustment and locking dial with field angle indicators

(c) Scale markings on lens tube

(d) Insulated rear handle

(e) Double clutch fixture body for both 15-30 degrees and 25-50 degrees version

(f) Integral cable clamp for power leads

(g) Positive locking of lamp focus and independent lamp alignment controls unaffected by relamping

(h) High impact, thermally insulated knobs and shutter handles

(i) Reflector secured with shock mounts

(j) Rotating shutter assembly – 50 degrees rotation

(k) 20 gauge stainless steel shutters

(l) Interchangeable / retrofitable rotating lens tube

(m) Lens tube door for easy access to lenses

(n) Sturdy gel frame holders with two accessory slots, and a top mounted, quick release electroplated black gel frame retainer

(o) Rugged 4.8mm x 31.8mm steel yoke with two mounting positions allowing 300 deg. + rotation of the fixture within the yoke for 25-50 degrees version

(p) Positive locking, hand operated yoke clutch

(q) Slot with sliding cover for motorized pattern devices or optional iris

c. Optical

(1) The optical train shall combine a compact filament lamp with a precision molded borosilicate ellipsoidal reflector and dual Anti-reflection coated precision aspheric lens system to produce a highly efficient optimum cosine field and sharp pattern projection.

(2) The unit shall provide, but not be limited to:

(a) Molded borosilicate reflector with multiple dichroic layers

(b) 95% of visible light shall be reflected while 90% of infrared light as heat shall be transmitted through the reflector and removed from the projected beam.

(c) Low gate and beam temperature

(d) Sharp imaging through a three plane shutter design

(e) For the 15-30 deg. Zoom - Two Bi-Convex aspheric lenses with an anti-reflective coating to increase lens transmission.

(f) For the 25-50 deg. Zoom - a Plano-Convex aspheric front lens with an anti-reflective coating and a Bi-convex aspheric rear lens with an anti-reflective coating to increase lens transmission.

d. Performance

(1) The unit shall be precision engineered to use an HPL lamp to deliver an even, intense field with cosine distribution. Nominal field angle cosine field lumen output shall be at least 12,360 lumens for both versions.

(2) The unit shall provide, but not be limited to:

(a) 15-30 deg. or 25-50 deg. field angle range

(b) Smooth, easy lens movement and single hand adjustment for simultaneous field angle and focus setting.

(c) Projector-quality pattern imaging (stainless steel, glass, and rotating patterns)

(d) Sharp shutter cuts without halation

(e) Shutter warping and burnout in normal use shall be unacceptable

(f) Adjustable hard and soft beam edges

e. Lamps

(1) The high efficiency lamps shall be an HPL575W/115X+ lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp shall mount axially within the reflector. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment. The lamp socket shall be ATP 220 nickel gold plated.

Ellipsoidal Zoom Spotlights (TI3):

a. General

(1) The instrument shall be a Source Four PAR EA spotlight as manufactured by Electronic Theatre Controls, Inc., or approved equal.

b. Physical

(1) The unit shall be constructed of rugged, die cast aluminum and extruded aluminum, free of burrs and pits, finished in white, high temperature epoxy paint. Tools shall not be required for cleaning the reflector or lens.

(2) The following shall be provided:

(a) Integral cable clamp for power leads

(b) High impact, thermally insulated knobs

(c) Sealed reflector housing shall prevent all light leaks. Temperature control of reflector is obtained through 17 heat sink fins cast into the housing.

(d) Interior of unit shall contain ten baffles to eliminate beam scattering and spill light.

(e) Lamp socket shall be held into place by a brass self-retaining screw.

(f) Lens shall be secured with cast bosses and high temperature bronze spring release. No tools shall be required to change lenses.

(g) Sturdy gel frame holders with two accessory slots and a top mounted, quick release gel frame retainer

(h) Rugged steel yoke with two mounting positions 300°+ Rotation of fixture within yoke

(i) Positive locking, hand operated yoke clutch

(3) Each unit shall be provided standard with colorframe and 915mm bare lead.

(4) The spotlight shall be UL and cUL listed and so labeled

c. Optical

(1) The optical train shall combine a compact filament lamp with modified parabolic and multifaceted reflector. Reflector efficiency shall be a minimum of 93%. Reflector shall be cast into a heat sink assembly. Reflector finish shall be an enhanced aluminum deposition. Reflectors of pressed aluminum sheet

d. Lamps

(1) The high efficiency lamps shall be HPL575W/115X+ lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp shall mount axially within the reflector. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment. The lamp socket shall be ATP 220 nickel gold plated.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment according to manufacturer's written instructions.

Set permanently mounted items plumb and level and square with ceilings and walls.

Mounting of Equipment: Conform to manufacturer's instructions.

3.2 IDENTIFICATION

Identify components and power and control wiring in accordance with Section 16415 Electrical Interior Work.

Label each luminaire, lighting outlet, and dimmer module with a unique designation. Make designations on elevated components readable from the floor. Use 53mm minimum size labels on connector strips.

3.3 CONTROL WIRING INSTALLATION

Install wiring between control devices in accordance with Section 16415 Electrical Interior Work for hard wired connections. Install wiring in conduit or raceway except cable and plug connections.

3.4 FIELD QUALITY CONTROL

Manufacturer's Field Services: Arrange and pay for the service of a factory-authorized service representative to test, adjust, and program the lighting control system.

Test Labeling: Upon satisfactory completion of all tests and observations, the Contractor shall apply a label to tested components indicating test results, date, and responsible organization and person.

Schedule visual and mechanical inspections and electrical tests with at least 14-days advanced notification to the Theatrical Lighting Provider.

Visual and Mechanical Inspections shall include the following.

a. Inspect each luminaire, outlet, module, and item of equipment for defects, finish failure, corrosion, and physical damage, UL labeling, and nameplate.

b. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions or routine functional operation.

c. Check tightness of electrical connections with torque wrench calibrated within the previous 6 months. Use manufacturer's recommended torque values.

d. Verify proper protective device settings and fuse types and ratings.

Additional electrical tests shall be preformed by the Contractor according to manufacturer's instructions. Exercise caution when testing devices containing solid-state components.

a. Insulation resistance tests of conducting parts of control components and connecting supply feeder and control circuits. Minimum acceptable insulation resistance is 100 M-ohms or greater.

b. Provide continuity tests of all circuits.

3.5 CLEANING AND ADJUSTING

Prior to system turn-over to the Government, the Contractor shall remove paint splatters and other spots, dirt, and debris. Repair scratches andmars of finish to match original finish. Clean luminaires, devices, and equipment internally and externally, using methods and materials as recommendedby equipment manufacturers and/or Contractor.

3.6 OWNER DEMONSTRATION

The Contractor shall demonstrate functions, features, and adjustments for each luminaire type with luminaire energized and operating with the indicated lamp.

The Contractor shall demonstrate the system to prove compliance with operational requirements.

Direct Training: Arrange and pay for the services of a factory authorized service representative to demonstrate lighting control system and train Government personnel.

a. The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHSformat video tape of the entire training shall be submitted.

3.7 COMMISSIONING

Operational Tests: Energize lighting controls systems, program controls, and check controlled outlets for light levels. Program test scenes so every luminaire is tested throughout its operating power range with the installed lamp. Check programmed function at each house control, entry, and emergency light control station. Adjust components and revise installation tocorrect deficiencies.

Correct deficiencies and retest deficient items. Verify by the system tests that specified requirements are met.

-- End of Section --

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SECTION 16475

COORDINATED POWER SYSTEM PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE Std 242	(2001) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - Buff Book
IEEE Std 399	(1997) Recommended Practice for Power Systems Analysis - Brown Book

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fault Current Analysis; G
Protective Device Coordination Study; G
Arc-Flash Hazard Analysis; G

The study along with protective device equipment submittals. No time extensions or similar contact modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed will be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Equipment;

Data consisting of manufacturer's time-current characteristic curves for individual protective devices, recommended settings of adjustable protective devices, recommended ratings of non-adjustable protective devices and Arch-Flash labels for personal protective equipment.

System Coordinator; G

Verification of experience and license number, of a registered Professional Engineer with experience in the design of coordinated power system protection. Experience data shall include at least five references for work of a magnitude comparable to this contract, including points of contact, addresses and telephone numbers. This engineer must perform items required by this section to be performed by a registered Professional Engineer.

Protective Relays;

Data shall including calibration and testing procedures and instructions pertaining to the frequency of calibration, inspection, adjustment, cleaning, and lubrication.

Installation;

Procedures including diagrams, instructions, and precautions required to properly install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Field Testing; G

The proposed test plan, prior to field tests. Plan shall consist of complete field test procedure including tests to be performed, test equipment required, and tolerance limits, including complete testing and verification of the ground fault protection equipment, where used. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-07 Certificates

Devices and Equipment; G

Certificates certifying that all devices or equipment meet the requirements of the contract documents.

1.3 SYSTEM DESCRIPTION

The power system covered by this specification consists of the building service transformer and continuing through construction to low voltage branch circuits in the building distribution systems.

1.4 QUALIFICATIONS

1.4.1 System Coordinator

System coordination, recommended ratings and settings of protective devices, and design analysis shall be accomplished by a registered professional electrical power engineer with a minimum of two years of current experience in the coordination of electrical power systems.

1.4.2 System Installer

Calibration, testing, adjustment, and placing into service of the protective devices shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience in protective devices.

1.5 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced.

1.6 PROJECT/SITE CONDITIONS

Devices and equipment furnished under this section shall be suitable for the following site conditions. Seismic details shall conform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT, 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT AND 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Protective devices and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory utility type use for at least two years prior to bid opening.

2.2 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three

years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.2.1 Scope of Analyses

The fault current analysis and protective device coordination study shall begin at the buildings service transformer and extend through the building's distribution system.

2.2.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented.

2.2.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Location of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.2.4 Fault Current Analysis

2.2.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

2.2.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedance shall be those proposed. Data shall be documented in the report.

2.2.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.2.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. A written narrative shall be provided describing:

which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost damages (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.2.6 Arc-Flash Study

The analysis shall calculate the flash protection boundary and the incident energy at each bus in the building's distribution system. The analysis shall be done in accordance with the recommendations in IEEE Std 1584-2002. The study shall include a table listing the hazard risk category and the worker's protective clothing system for each item in the analysis.

2.2.7 Study report

a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.

b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings; and existing power system data including time-current characteristic curves and protective device ratings and settings.

d. The report shall contain fully coordinated composite time-current characteristics curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.

e. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.2 INSTALLATION

Protective devices shall be installed in accordance with the manufacturer's published instructions and in accordance with the requirements of NFPA 70 and IEEE C2.

3.3 FIELD TESTING

3.3.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

3.3.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

-- End of Section --

SECTION 16528

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-4	(2001; 2002 Interim) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1	(2002) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.1	(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C136.10	(1996) Roadway Lighting-Locking Type Photocontrol Devices and Mating Receptacle - Physical and Electrical Interchangeability and Testing
ANSI C136.11	(1995) Roadway Lighting Equipment Series Sockets and Series Sockets Receptacles
ANSI C136.15	(1997) Roadway Lighting Equipment High Intensity Discharge and Low Pressure Sodium Lamps in Luminaires, Field Identification
ANSI C136.2	(1996) Roadway Lighting Equipment: Luminaires, Voltage Classification
ANSI C136.3	(1995) Roadway Lighting Equipment-Luminaire Attachments
ANSI C136.6	(1997) Roadway Lighting Equipment - Metal

	Heads and Reflector Assemblies - Mechanical and Optical Interchangeability
ANSI C136.9	(1990) Roadway Lighting Equipment - Socket Support Assemblies for Metal Heads - Mechanical Interchangeability
ANSI C78.1	(1991; R 1998) For Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Single Ended Metal-Halide Lamps
ANSI C80.1	(1994) Rigid Steel Conduit - Zinc Coated
ANSI C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 48M	(2000) Gray Iron Castings (Metric)
ASTM A 575	(1996; R 2002) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 2000) Steel Bars, Carbon, Hot-Wrought, Special Quality

ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM B 2	(2000) Medium-Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C 478	(2003) Precast Reinforced Concrete Manhole Sections
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA RP-8	(2000) Roadway Lighting
IESNA RP-33-99	(1999) Lighting for Exterior Environments
IESNA RP-20-98	(1998) Lighting for Parking facilities

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C136.13	(1992) Roadway Lighting Equipment, Metal Brackets for Wood Poles
IEEE C2	(2002) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000) Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures

NEMA OS 1	(1996) Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA RN 1	(1998) Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1029	(1994; Rev thru Feb 2001) High-Intensity-Discharge Lamp Ballasts
UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 44	(1999; Rev thru May 2002) Thermoset-Insulated Wires and Cables
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru May 2001) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 514B	(1997; Rev thru Feb 2002) Fittings for Cable and Conduit
UL 514C	(1996; Rev thru Nov 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(2000; Rev thru Oct 2002) Type EB and A Rigid PVC Conduit and HDPE Conduit

UL 854	(1999; Rev thru Nov 2002) Service-Entrance Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting System; G
Detail Drawings; G

Detail drawings for the complete system and for poles, lighting fixtures, and controllers.

As-Built Drawings;
The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Equipment and Materials;

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

Spare Parts;

Spare parts data for each item of material and equipment specified, after approval of detail drawings for materials and equipment, and not later than 4 months before the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and sources of supply.

SD-06 Test Reports

Operating Test; G

Test procedures and reports for the Operating Test. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

Ground Resistance Measurements;

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-10 Operation and Maintenance Data

Lighting System;

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Contractor shall provide documentation for LEED certification in accordance with SECTION 01335 SUSTAINABLE DESIGN AND CONSTRUCTION PROCEDURES. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

1.3 SYSTEM DESCRIPTION

1.3.1 Lighting System

The lighting system shall be configured as specified and shown. The

lighting system shall conform to the light levels and uniformity ratios of IESNA RP-33-99 and IESNA RP-20-98. The lighting system shall meet the requirements to achieve LEED credit 8, Light Pollution Reduction, in accordance with 3.3.1.9 of Section 01335 SUSTAINABLE DESIGN AND CONSTRUCTION PROCEDURES.The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.3.2 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.3.3 Power Line Surge Protection

Transient voltage surge suppressors shall be provided for all electronic equipment. Surge suppressors shall meet the requirements of IEEE C62.41, and be UL listed as having been tested in accordance with UL 1449. Surge suppressor ratings shall be as indicated. Fuses shall not be used as surge suppression.

1.3.4 Interface Between Lighting System and Power Distribution

Conductors shall be as indicated.

1.3.5 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.3.6 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.4 CORROSION PROTECTION

1.4.1 Aluminum Materials

Aluminum shall not be used.

1.4.2 Ferrous Metal Materials

1.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

1.4.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch) from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.4.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in Section 09900 PAINTS AND COATINGS.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 On Aluminum, Steel, Fiberglass, and Concrete Poles

Poles shall be provided with bracket arms of the style and of the length indicated on drawings. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with IEEE C136.13. Steel brackets shall be galvanized. Wood bracket arms shall not be used.

2.2.2 Floodlight Brackets

Floodlight brackets shall be coordinated with the floodlight support provided.

2.3 CABLE

The Contractor shall provide all wire and cable. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and

type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Cable shall be provided with insulation of a thickness not less than that given in column A of TABLE 15.1 of UL 854. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded.

2.3.2 Bare Copper Conductors

Medium-hard-drawn copper conductors shall conform to ASTM B 2 and ASTM B 8.

2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

2.5 CABLE BOXES

Boxes and covers shall be made of cast iron with zinc coated or aluminized finish, and shall be of the sizes indicated on drawings. The minimum inside dimensions shall be not less than 304.8 mm (12 inches) square by 152.4 mm (6 inches) deep and not less than required to house the cable splice. A suitable gasket shall be installed between the box and cover for watertightness. A sufficient number of screws shall be installed to hold the cover in place along the entire surface of contact. Grounding lugs shall be provided.

2.6 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast concrete manholes shall have the required strength established by ASTM C 478. Frames and covers for manholes shall be made of gray cast iron or cast steel. A machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48M , Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 69 MPa and a flexural strength of at least 34.5 MPa Pullbox and handhole covers in parking lots, sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.7 CONDUIT, DUCTS AND FITTINGS

2.7.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

2.7.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic

resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

2.7.3 Conduit Fittings and Outlets

2.7.3.1 Boxes, Metallic Outlets

NEMA OS 1 and UL 514A.

2.7.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.7.3.3 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

2.7.3.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.7.3.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.7.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. High-density conduit shall conform to UL 651A. Schedule 40 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with 75 degree C (167 degrees F) wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

2.8 GROUND RODS

Ground rods shall be of copper clad steel conforming to UL 467 not less than 19.1 mm (3/4 inch) in diameter by 3.1 m (10 feet) in length of the sectional type driven full length into earth.

2.9 POLES

Metal and concrete poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. Poles shall be designed for a wind velocity of 35.8 meters per second (80 mph) at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by AASHTO LTS-4. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole shaft material

provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

2.9.1 Concrete Poles

Concrete poles shall be designed to withstand the loads specified in IEEE C2 multiplied by the appropriate overload capacity factors. Poles shall be reinforced or prestressed, either cast or spun. Spun poles shall be manufactured by a centrifugal spinning process with concrete pumped into a polished round tapered metal mold. Concrete for spun poles shall have a compressive strength of at least 34.5 MPa (5,000 psi) at 28 days; steel wire shall have an ultimate tensile strength of at least 827 MPa (120,000 psi); and reinforcing bars shall have an ultimate tensile strength of at least 276 MPa (40,000 psi). After the high speed spinning action is completed, a spun pole shall be cured by a suitable wet steam process. Spun poles shall have a water absorption of not greater than 3 percent to eliminate cracking and to prevent erosion. Concrete poles shall have hollow shafts. Poles shall have a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water and frost. Poles shall not be installed for at least 15 days after manufacture. Fittings and brackets that conform to the concrete pole design shall be provided. Poles shall conform to strength calculations performed by a registered professional engineer and submitted in accordance with detail drawings portion of paragraph SUBMITTALS.

2.9.2 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.10 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M.

2.11 ELECTRICAL ENCLOSURES

The Contractor shall provide metallic enclosures as needed to house the lighting equipment. Enclosures shall conform to NEMA ICS 6 and NEMA 250. Enclosures shall be provided with lockable or padlock handles. Keys for lockable enclosures shall be delivered to the Contracting Officer. The enclosures shall be as specified or as shown on the drawings.

2.11.1 Interior Enclosures

Enclosures to house lighting equipment in an interior environment shall meet the requirements of a NEMA 12 enclosure as defined in NEMA 250.

2.11.2 Exposed-to-Weather Enclosures

Enclosures to house lighting equipment in an outdoor environment shall meet

the requirements of a NEMA 4 enclosure as defined in NEMA 250.

2.12 ILLUMINATION

2.12.1 General Lighting

Luminaires, ballasts, lamps, and control devices required for parking area and walkway lighting, including floodlighting shall be as specified and as shown on the drawings.

2.13 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.13.1 High-Pressure Sodium

Lamps shall conform to ANSI C78.1350 or ANSI C78.1351 or ANSI C78.1352 or ANSI C78.1355. Ballasts shall conform to ANSI C82.4, or UL 1029. High-pressure sodium lamps shall be clear.

2.13.2 Metal-Halide

Lamps shall be made by a manufacturer with not less than 5 years experience in making metal-halide lamps. Metal-halide lamps shall conform to ANSI C78.1375 or ANSI C78.1376. Ballasts shall conform to ANSI C82.4 or UL 1029.

2.14 LAMPS, FLUORESCENT

Fluorescent lamps shall have standard cool-white color characteristics and shall not require starter switches. The lamps shall be of the rapid-start type.

2.15 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

2.16 LIGHTING CONTROL EQUIPMENT

2.16.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately 5.4 to 53.8 lux.

2.16.2 Manual Control Switches

Manual control switches shall conform to UL 98. The switches shall be the heavy-duty type and shall be suitable for operation on a 120 volt, 60 Hz system. The number of poles and ampere rating shall be as indicated. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. The selector switch shall have a minimum of three positions: ON, OFF, and AUTOMATIC. The automatic selection shall be used when photoelectric control is desired. The

selector switch shall interface with the lighting system magnetic contactor and control its activity.

2.16.3 Safety Switches

Switches shall be the heavy-duty type with NEMA ICS 6 Type 4 enclosures and shall be suitable for operation on a system as indicated on the drawings. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. Blades shall be visible with door open and shall be of the quick-make, quick-break type. Terminal lugs shall be coordinated with the wire size. Switches shall conform to UL 98.

2.16.4 Magnetic Contactor

Magnetic contactors shall be mechanically held, electrically operated, and shall conform to NEMA ICS 1 and NEMA ICS 2. The contactor shall be suitable for the voltage system indicated on the drawings. Coil voltage, maximum continuous ampere rating, and number of poles shall be as indicated on drawings. Enclosures for contactors mounted indoors shall be NEMA ICS 6, Type 1. Each contactor shall be provided with a spare, normally open auxiliary contact. Terminal lugs shall be coordinated with the wire size.

2.17 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA RP-8.

2.18 LUMINAIRES, FLOODLIGHTING

2.18.1 HID

HID lighting fixtures shall conform to UL 1572.

2.18.2 Fluorescent

Fluorescent lamps shall conform to ANSI C78.1.

2.19 FIXTURES

Fixtures shall be as detailed on the drawings. Illustrations on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

2.19.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

2.19.2 In-Line Fuse

In-line fuses shall be provided for each fixture, and shall consist of a fuse in each phase conductor in a UL approved waterproof fuse holder.

2.20 FLUORESCENT FLOODLIGHTS, EXTERIOR

Fluorescent floodlight fixtures shall be suitable for outdoor installations and shall use a T-8, rapid start lamp. The fixture shall consist of a highly polished aluminum reflector with specular finish. The fixture sockets shall be spring loaded, and shall have plunger sockets with silver-plated contacts and neoprene boots. The fixture shall have provisions for aiming throughout 360 degrees of rotation with a graduated aiming dial. Door assembly shall consist of a stainless steel frame, a clear acrylic plastic cover, a sponge neoprene weatherproof gasket, and stainless steel hinges and latches. Housing shall be finished with acrylic baked enamel. The fixture shall be equipped with a mounting hub assembly at each end. The fixture shall be provided with a thermally protected, weatherproof, high power factor ballast, not integral with the fixture, for remote mounting. The ballast shall be rated for minus 29 degrees C (minus 20 degrees F) for cold weather starting.

2.21 TRANSFORMERS

Transformers for the roadway lighting system shall be in accordance with, specification 16375, Electrical Distribution System, Underground.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.3 PREVENTION OF CORROSION

3.3.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

3.3.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or

penetrating slabs-on-grade, shall be field wrapped with 254 micrometers (0.010 inch) thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

3.3.3 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.4 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each handhole and at each terminal.

3.4.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

3.4.2 Installation in Duct Lines

Ground and neutral conductors shall be installed in duct with the associated phase conductors. Cable splices shall be made in handholes only.

3.5 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. Empty conduits to the indicated equipment from a point 1.5 m outside the building wall and 600 mm below finished grade are specified in Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

3.6 DUCT LINES

3.6.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 100 mm per 30 m. Depending on the contour of the finished grade, the high point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short radius manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically

indicated as acceptable. The minimum manufactured bend radius shall be 450 mm (18 inches) for ducts of less than 80 mm (3 inches) in diameter, and 900 mm (36 inches) for duct 80 mm (3 inches) or greater in diameter. Otherwise, long sweep bends having a minimum radius of 7.6 m (25 feet) shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes.

3.6.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and shall match factory tapers. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.6.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70 except that electrical duct bank configurations for ducts 150 mm (6 inches) in diameter shall be determined by calculation and as shown on the drawings. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. At any point, except railroad and airfield crossings, tops of concrete encasements shall not be less than the cover requirements listed in NFPA 70. Where ducts are jacked under existing pavement, rigid steel conduit shall be installed. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not more than 1.2 m on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete, and joints shall be staggered at least 150 mm vertically.

3.6.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 460 mm, but not less than 610 mm below finished grade and shall be installed with a minimum of 75 mm of earth around each duct, except that between adjacent electric power and communication ducts, 300 mm of earth is required. Bottom of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 75 mm layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 150 mm. The first 150 mm layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 75 to 150 mm

layers. Duct banks may be held in alignment with earth. However, high tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.6.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendation for the particular type of duct and coupling selected and as approved.

3.6.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4 turn to set the joint tightly.

3.6.6 Concrete

Concrete work shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be plain, 17 MPa (2500 psi) at 28 days, except that reinforced concrete shall be 21 MPa (3000 psi) at 28 days. Duct line encasement shall be of monolithic construction. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded or doweled to the existing encasement.

3.6.7 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other duct locations that are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 0.127 mm (5 mil) brightly colored plastic tape, not less than 75 mm (3 inches) in width and suitably inscribed at not more than 3 m (10 feet) on centers with a continuous metallic backing and a corrosion-resistant 0.0254 mm (1 mil) metallic foil core to permit easy location of the duct line, shall be placed approximately 300 mm below finished grade levels of such lines.

3.7 HANDHOLES

The exact locations shall be determined after carefully considering the locations of other utilities, grading, and paving. Exact locations shall be approved before construction is started.

3.7.1 Construction

Handholes shall be constructed as indicated on drawings, including appurtenances. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic construction. Concrete shall be 21 MPa at 28 days. Precast concrete handholes having the same strength and inside dimensions as cast-in-place concrete handholes may be used. In paved areas, the top of entrance covers shall be flush with the finished surface of the paving. In unpaved areas, the top of entrance covers shall be approximately 15 mm above the finished grade. Where

finished grades are in cut areas, unmortared brick shall be installed between the top of handhole and entrance frame to temporarily elevate the entrance cover to existing grade level. Where duct lines enter walls, the sections of duct may be cast in the concrete or may enter the wall through a suitable opening. The openings around entering duct lines shall be caulked tight with lead wool or other approved material.

3.7.2 Appurtenances

The following appurtenances shall be provided for each handhole.

3.7.3 Cable Pulling-In Irons

A cable pulling-in iron shall be installed in the wall opposite each duct line entrance.

3.7.4 Ground Rods

In each handhole, at a convenient point close to the wall, a ground rod conforming to paragraph GROUNDING shall be driven into the earth before the floor is poured; approximately 100 mm of the ground rod shall extend above the floor after pouring. When precast concrete units are used, the top of the ground rod may be below the floor; a No. 1/0 AWG copper ground conductor shall be brought inside through a watertight sleeve in the wall.

3.8 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height as indicated on the drawings. Luminaire mounting height may be increased by the height of the transformer base where required. Electrical cabling shall be provided to the light pole as specified. The mount interfaces shall have ac power connected, and the pole wiring harness shall be connected to the luminaire. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and IEEE C2. Poles shall be set straight and plumb.

3.8.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer and as shown on drawings. Mounting hardware shall be sized appropriately to secure the mount, luminaire, and housing with wind and ice loading normally encountered at the site. Pole brackets for floodlights shall have the number of tenons indicated, arranged to provide the indicated spread between each tenon. Where indicated on drawings, adjustable heads shall be installed on the brackets to position the luminaires. Identical brackets shall be used with one type of luminaire.

3.8.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete

shall be 21 MPa (3000 psi) at 28 days.

3.8.3 Rigid Steel Conduit Ells

Rigid steel conduit ells shall be provided at all poles.

3.8.4 Aluminum, Steel, Fiberglass and Concrete Pole Installation

Poles shall be mounted on cast-in-place or power-installed screw foundations. Concrete poles shall be embedded in accordance with the details shown. Conduit elbows shall be provided for cable entrances into pole interiors.

3.8.4.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufactures standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

3.8.4.2 Power-Installed Screw Foundations

Power-installed screw foundations having the required strength mounting bolt and top plate dimensions may be utilized. Screw foundations shall be of at least 6.4 mm (1/4 inch) thick structural steel conforming to ASTM A 36/A 36M and hot-dip galvanized in accordance with ASTM A 123/A 123M. Conduit slots in screw foundation shafts and top plates shall be marked to indicate orientation. Design calculations indicating adequate strength shall be approved before installation of any screw foundation.

3.9 LIGHTING

3.9.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.9.2 Fixture Installation

Fixtures shall be installed as detailed on the drawings. Special fixtures shall be as indicated on drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

3.9.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.9.2.2 In-Line Fuses

In-line fuses shall be provided in all phase conductors each fixture.

3.10 LIGHTING CONTROL SYSTEM

3.10.1 Photo-Control

Lighting luminaires shall be controlled in banks by a single photo-control element mounted within each bank.

3.10.2 Manual and Safety Switches

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 6.4 mm (1/4 inch) bolts. The use of sheet metal screws will not be allowed.

3.10.3 Magnetic Contactors

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 6.4 mm (1/4 inch) bolts. The use of sheet metal screws will not be allowed.

3.11 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately 300 mm below finished grade, except in handholes.

3.11.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors, to achieve the specified ground resistance. The additional electrodes shall be up to three, 3 m long rods spaced a minimum of 3 m apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.11.2 Items to be Grounded

Ground conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

3.11.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal or concrete lighting poles shall be connected to ground rods by means of No. 8 AWG bare copper wire. Lighting fixture brackets on wood and concrete poles shall be grounded to a No. 6 AWG bare copper grounding conductor connected to the ground rod.

3.11.4 Handhole

In each handhole, at a convenient point close to the wall, a ground rod shall be driven into the earth before the floor is poured, and approximately 100 mm of the ground rod shall extend above the floor after pouring. When precast concrete units are used, the top of the ground rod may be below the floor, and a No. 1/0 AWG copper ground conductor shall be brought inside through a watertight sleeve in the wall. Connection to ground rods shall be by means of bolted-clamp terminals or by an approved fusion-welding process. Ground wires shall be neatly and firmly attached to handhole walls, and the amount of exposed bare wire shall be held to a minimum.

3.11.5 Metal Cable Boxes

Metal cable boxes for direct-burial cable shall be connected to adjacent ground rods by wires with current-carrying capacities of at least 20 percent of the spliced phase conductors, but not less than No. 6 AWG.

3.12 TESTS

3.12.1 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

3.12.2 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in IEEE Std 81.

The contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the lighting to be used for "as-built" drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the lighting system. In addition to being complete and accurate, this set of drawings shall be kept neat and

shall not be used for installation purposes. Upon completion of the as-built drawings, a representative of the Government will review the as-built work with the Contractor. If the as-built work is not complete, the Contractor will be so advised and shall complete the work as required.

-- End of Section --

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-B	(2001) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-568-B.2-1	(2002) Transmission Performance Specifications for 4-pair 100 ohm Category 6 Cabling
EIA ANSI/TIA/EIA-569-A	(2001) Commercial Building Standard for Telecommunications Pathways and Spaces
EIA ANSI/TIA/EIA-606A	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
EIA ANSI/TIA/EIA-607A	(1994) Commercial Building Grounding/Bonding Requirement Standard
EIA TIA/EIA-TSB-67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

IBM CORPORATION (IBM)

IBM GA27-3361-07	(1987) LAN Cabling System - Planning and Installation

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596	(1994) Fiber Optic Premises Distribution Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building. The contractor shall coordinate all work with the 1115th Signal Command also referred to as the Directorate of Information Management (DOIM); point of contact is Cliff Hawkeswood 253-967-6789. There is no charge by the DOIM for their coordination work.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Premises Distribution System; G

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606A. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Record Keeping and Documentation; G

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606A.

Spare Parts

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-06 Test Reports

Test Reports;

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 89 mm diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

SD-07 Certificates

Premises Distribution System;

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-B.2-1, EIA ANSI/TIA/EIA-569-A, and EIA ANSI/TIA/EIA-606A standards.

Materials and Equipment;

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.

c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format on electronic media using Windows based computer cable management software per EIA ANSI/TIA/EIA-606A. A licensed copy of the cable management software including documentation, shall be provided. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility per EIA ANSI/TIA/EIA-606A.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format on electronic media using Windows based computer cable management software per EIA ANSI/TIA/EIA-606A. A licensed copy of the cable management software including documentation, shall be provided. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606A.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B for Category 3 100-ohm unshielded twisted pair cable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMR or CMP as appropriate per NFPA 70. All cables shall be labeled at both ends.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B.2-1

for Category 6. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP, as appropriate, per NFPA 70. All cables shall be labeled at both ends.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with EIA ANSI/TIA/EIA-568-B.

2.2.3.1 Telecommunications Outlets

Outlet plates shall come equipped with four modular jacks. Wall outlets shall come equipped with a single modular jack. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Voice jacks shall match the faceplate color and shall be the 6-pin type. Data jacks shall be blue in color and shall be the 8-pin type. Outlet assemblies used in the premises distribution system shall consist of individual modular jacks in single gang covers and shall be wired as indicated on the drawings. The modular jacks shall conform to the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 6 cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-6. Modular jack pin/pair configuration shall be T568A per ANSI/TIA/EIA-568-A. Modular jacks shall be unkeyed.

2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 480 mm rack mounted panels. Jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Jacks shall be unkeyed. Jacks shall be labeled as indicated. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1.

2.2.3.3 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 66 which meet the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 FIBER OPTIC CABLE SYSTEM

2.3.1 Horizontal Distribution Cable

2.3.1.1 Multimode

Multimode fiber optic horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B and ICEA S-83-596 for 62.5/125 micrometer multimode graded index optical fiber cable. Numerical aperture for each fiber shall be a minimum of 0.275. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of 1.0 m. Cable shall be rated and marked OFNP per NFPA 70.

2.3.2 Connecting Hardware

2.3.2.1 Connectors

Connectors shall be ST type with ceramic ferrule material with a maximum insertion loss of.5 dB. Connectors shall meet performance requirements of EIA ANSI/TIA/EIA-568-B. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic, double gang, with double-sided female ST coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.3.2.2 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 480 mm rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be labeled as indicated. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.3.2.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

2.4 EQUIPMENT RACKS

2.4.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be welded steel relay racks with uprights to mount equipment 480 mm wide. Uprights shall be 75 mm deep channel, 32 mm wide, drilled and tapped 12-24 in a 13 mm pattern. Racks shall be provided with a standard top crossmember, and predrilled base

plate to allow floor fastening. Open frame equipment racks shall be 2.1 m in height and clear coated. AC outlets shall be provided on each rack.

2.4.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 480 mm equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.5 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

2.6 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 117 mm square by 53 mm deep with minimum 9 mm deep single or two gang plaster ring as shown. Provide a minimum 25 mm conduit.

2.7 COAXIAL CABLE

Coaxial cable shall be RG-6, quad shield; 0.040 in. (1.02 mm) copper covered steel center conductor; gas expanded polyethylene dielectric; inner shield of aluminum-polypropylene-aluminum tape bonded to the dielectric; 34 AWG bare aluminum braid wire; non-bonded aluminum-polypropylene-aluminum tape; 34 AWG bare aluminum braid wire; jacket of black polyvinylchloride or polyethylene (flooded). Nom. O.D. 0.300 in. (7.06 mm).

Frequency (MHz)	Maximum (db/100 ft)	Maximum (db/100 m)
55	1.60	5.25
187	2.85	9.35
250	3.30	10.82
350	3.85	12.63
450	4.40	14.43

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606A. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-B and as specified in

Section 16415 ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606A. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through cable trays to prevent microbending losses. Conduit shall be electrically bonded to cable tray. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 1.8 m long shall be neatly coiled not less than 300 mm in diameter below each feed point in raised floor areas.

3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Telecommunications Outlets

3.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 150 mm of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized. Prior to cable termination, Contractor shall verify block layout with the DOIM.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.6 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be 900 mm in length. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7 Equipment Racks

Open frame equipment racks shall be bolted to the floor slab. Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Ganged rack cabinets shall have adjacent side panels removed. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface. A vertical cable management device with a width between 100mm and 150mm shall be mounted on each side of each rack installed. Each rack shall be braced with local seismic level bracing in accordance with Section 16070.

3.1.8 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.1.9 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Shielded Twisted Pair Cable

Each cable shall be terminated on panel-mounted connectors. Cables shall be grounded at patch panels using manufacturer's recommended methods. Shield braid shall be continuous to connector braid terminator. Wire insulation shall not be damaged when removing shield.

3.2.3 Coaxial Cable

Home run type station cables shall be terminated at each end. Backbone cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with appropriate drop connectors and terminators as required. Backbone cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.2.4 Fiber Optic Cable

Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than 11.3 kg (. The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per EIA ANSI/TIA/EIA-568-B.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607A and Section 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

a. 10 of each type outlet.

b. 10 of each type cover plate.

c. 1 of each type terminal block for each telecommunications closet.

d. 4 Patch cords of 3 m for each telecommunications closet.

e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606A.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with the Ft Lewis standard labeling scheme indicated on the drawings.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using the Ft Lewis standard labeling scheme indicated on the drawings.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 6 Circuits

All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Shielded Twisted Pair

Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

3.6.4 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

3.6.5 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 1310 and 1550 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

-- End of Section --

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SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61	(1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA TIA/EIA-455-81B	(2000) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
EIA ANSI/EIA/TIA-455-30B	(1991) FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity
EIA ANSI/EIA/TIA-455-53A	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
EIA ANSI/EIA/TIA-455-78A	(1990; R 1998) FOTP-78 Spectral Attenuation Cutback Measurement for Single Mode Optical Fibers
EIA ANSI/TIA/EIA-568-A	(1995; Addendum 3 1998) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-607A	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 345-50	(1979) Trunk Carrier Systems
RUS 345-65	(1985) Shield Bonding Connectors
RUS 345-72	(1995) Field Splice Closures
RUS REA Bull 345-151	(1989) Conduit and Manhole Construction, REA Form 515c
RUS Bull 1751F-643	(1998) Underground Plant Design
RUS Bull 1753F-401	(1995) RUS Standard for Splicing Copper and Fiber Optic Cables
RUS IP 344-2	(1999) List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers
RUS REA Bull 1751F-641	(1995) Construction of Buried Plant
RUS Bull 1753F-201	(1976) Acceptance Tests and Measurements of Telephone Plant
RUS Bull 1753F-205	(1993) REA Specification for Filled Telephone Cables
RUS REA Bull 1753F-207	(1994) Terminating (TIP) Cable
RUS REA Bull 1753F-208	(1993) Filled Telephone Cables with Expanded Insulation
RUS REA Bull 1753F-601	(1994) REA Specification for Filled Fiber Optic Cables

UNDERWRITERS LABORATORIES (UL)

UL 497	(1995; Rev Oct 1999) Protectors for Paired Conductor Communication Circuits

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use. The Contractor shall coordinate with the 1115th Signal Command, also referred to as Directorate of Information Management (DOIM); point of contact is Cliff Hawkeswood, telephone 253-967-6789. There is no charge by the DOIM for their services.

a. The Contractor shall coordinate with the DOIM all the work required in the RSU to provide all new main distribution frame extensions, termination equipment, and cables for a complete outside plant system. Confirmation and identification of existing cables to be spliced and for splice pairs assignment shall be provided by the DOIM. Contractor shall provide 7 days notification before performing any splice to an existing cable.

b. The Contractor shall coordinate with the DOIM for termination locations on the new main distribution frame of RSU building for outside plant cable.

c. The Contractor shall coordinate with DOIM for final cable names.

d. The Contractor shall coordinate with the DOIM for Government furnished, Government installed instruments. Contractor shall provide supporting structures, wiring, and other equipment as indicated and test beforehand.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telephone System; G
Installation; G

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; G

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Spare Parts

Equipment

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Installation; G

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; G

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-06 Test Reports

Acceptance Tests;

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Telephone System;

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; G

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.4 QUALIFICATIONS

1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 65 degrees C with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class

of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

Cable shall be manufactured per RUS Bull 1753F-205 or RUS REA Bull 1753F-208. A 0.2 mm coated aluminum or 0.12 mm copper metallic shield shall be provided.

2.2.1.2 Screened

Screened cable shall comply with RUS Bull 1753F-205 or RUS REA Bull 1753F-208.

2.2.2 Fiber Optic Cable

Fiber optic cable shall be specifically designed for outside use with tight or loose buffer construction. The tight buffer optical fiber cable shall consist of a central glass optical fiber surrounded by a soft intermediate buffer to allow for thermal expansions and proper fitting of the secondary buffer. The loose buffer optical fiber cable shall have the glass optical fiber within a filled loose tube. All fiber optic cables used shall conform to the requirements of RUS REA Bull 1753F-601 including any special requirements made necessary by a specialized design.

2.2.2.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

2.2.2.2 Optical Fiber

Single-mode optical fibers shall be Class IV.

2.2.2.3 Shielding or Other Metallic Covering

A copper, copper alloy, or copper and steel laminate metallic covering or shield shall be provided per RUS REA Bull 1753F-601.

2.2.2.4 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from minus 20 to plus 60 degrees C. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 20 to plus 60 degrees C. The fiber optic cable shall not be damaged in storage

where the temperature may vary from minus 40 to plus 65 degrees C.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Closure

Underground closures shall conform to RUS 345-72. The closure shall be of Preformed stainless steel material, or equal, and be suitable for use in a vault or manhole. Encapsulating compounds shall not be used.

2.3.2 Fiber Optic Closures

2.3.2.1 Fiber Optic Underground

The underground closure shall be suitable to house a splice organizer in a protective housing. The closure shall be Preformed stainless steel material, or equal,and suitable for use in a vault or manhole. Encapsulating compounds shall not be used. All splices shall be flash tested using nitrogen gas to ensure dry and airtight seals. Flash test shall insure that the splice case with cable installed will hold positive pressure for a period of at least 30 minutes at 10 PSI. Soaping of case and adjacent cables throughout the duration of the pressure test is required to identify leaks.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS IP 344-2.

2.4.2 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

2.4.3 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic splices in a neat and orderly fashion. The splice organizer shall allow for a minimum of 1 m of fiber for each fiber within the cable to be neatly stored without kinks or twists. The splice organizer shall accommodate individual strain relief for each splice. The splice organizer shall allow for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.5 MANHOLE AND DUCT

All manhole and duct products shall conform to RUS Bull 1751F-643.

2.5.1 New Manholes

New manholes shall be equipped with pulling-in irons, cable racks, bonding ribbon and ground rod, and shall conform to the requirements of RUS REA Bull 345-151. Manholes shall be designed so that the main trunk conduits enter and exit in the lower-most portals of the ends, and lateral conduits exit on the sides near the corners. Manholes shall be Utility Vault 38Y 4868 TCA telecommunications manholes or approved equal.

2.5.2 Duct/Conduit

Conduit shall be furnished as specified in Sections 16415 ELECTRICAL WORK, INTERIOR and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.5.3 Innerduct

Innerduct shall be MAX-Cell fabric innerduct designed and manufactured for that purpose with a minimum of 9 individual pathways or approved equal.

2.6 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided as shown and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside telephone plant cable; to provide a demarcation point between inside and outside plant cable; and to allow inside and outside plant cable to be cross connected.

2.6.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be double sided welded steel relay racks with uprights to mount equipment 480 mm wide. Uprights shall be 75 mm deep channel, 32 mm wide, drilled and tapped 12-24 in a 13 mm pattern. Racks shall be provided with a standard top cross-member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 2.1 m in height and painted beige. AC outlets shall be provided as shown. Seismic bracing is required on all racks.

2.6.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 480 mm equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.6.3 Equipment Mounting Backboard

Backboards shall be 19 mm AC plywood, sized as shown, painted with white

or light colored paint and shall cover the entire walls.

2.7 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to RUS REA Bull 1753F-207.

Cable Protector terminals shall be MARCONI R399AAxxx (xxx=Stub length) wire wrap front facing terminals (or DOIM approved equal) for CO/RSU frame mounting at Communications Hut, Building #11940. Match existing terminals and rack or frame types when adding to an existing frame or rack system.

Cable protector terminals shall be Marconi BEP CG100CF type Building entrance protected terminals sized appropriately at the newly constructed building.

Each terminal shall be stenciled to indicate cable number and cable pairs, using black marking on a white designation strip. Frames and wall mounting brackets shall be provided as required to effectively secure the protected terminals. Grounding of each protected terminal with # 6 AWG is required to the nearest ground point. Electronic solid-state or Gas tube protection modules shall be provided to completely fill each protected terminal. Use Marconi R3B1E Gas tube protectors or approved equal.

2.8 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be heavy duty, A>10 kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with UL 497.

2.9 FIBER-OPTIC TERMINATIONS

2.9.1 Fiber Optic Connectors

All outside plant fiber strands shall be terminated in a ST type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtails are used, the connectors shall be terminated on a 3 m length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.9.2 Fiber Optic Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch

panels shall be 480 mm rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be the Ft Lewis standard labeling scheme indicated on the drawings. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.10 MISCELLANEOUS ITEMS

2.10.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with RUS 345-65.

2.10.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.10.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, 150 mm wide with a minimum strength of 12.1 MPa lengthwise and 10.3 MPa crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 1 m deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 1.2 m intervals.

2.10.4 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 152.5 m and at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bull 1751F-641.

3.1.2.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.2.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in section 07840 FIRE STOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.3 Manhole and Ducts

Manhole and duct systems shall be installed in accordance with Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Manholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.3.1 Innerduct Installation

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes. Innerduct shall be plugged at both ends with polyurethane foam duct seal; this material shall also be inserted between the innerduct and the duct if cables are placed in the innerducts. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving 50 mm exposed.

3.1.3.2 Pull Cord

Pull cords of 10 mm polypropylene shall be installed in all unused ducts and inner-ducts with a minimum of 610 mm spare cord protruding from each end.

3.1.4 Surge Protection

Except for fiber optic cable, all cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of RUS 345-50 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bull 1753F-401. Modular splicing shall be used on all cables larger than 25 pairs. Splicing of cable into one continuous length is required. All pairs shall be spliced, including those indicated as dead pairs unless otherwise noted. The completed splices shall not cause the connected cable to fail to meet the same performance and mechanical specifications of a single similar cable of the same overall length. Single plastic insulated conductors shall be spliced using self-piercing electrical filled connectors, (Scotch locks and bean type connectors shall not be used.) Modular splicing techniques are required and shall be utilized on all mainline splices and splices exceeding 25 pair, using Thomas & Betts/ 3M Wire Mate 710 cutter/presser splice tool and connectors, or equal. Cable sheaths shall be bonded together at all cable splices with bonding harness to maintain sheath continuity. Splices shall be grounded to the manhole/Handhole ground system. Deviation from the cable splicing arrangements shown on the project drawings will not be allowed except as specifically approved by the Contracting Officer.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Ground Bars

3.3.1.1 Telecommunications Master Ground Bar (TMGB)

A copper TMGB shall be provided, in accordance with EIA ANSI/TIA/EIA-607A, to be the hub of the basic grounding system by providing a common point of connection for ground from outside cable, MDF, and equipment. The TMGB shall have a ground resistance, including ground, of 10 ohms or less.

3.3.1.2 Telecommunications Ground Bar (TGB)

Copper TGB shall be provided in accordance with EIA ANSI/TIA/EIA-607A in each communications closet and room and each frame. The TGB shall be connected to the TMGB in accordance with EIA ANSI/TIA/EIA-607A. Each TGB shall be connected to the TMGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 ohms.

3.3.2 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.3 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.4 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.3.5 Protection Assemblies

The protector assemblies shall be mounted directly on the vertical frame ironwork. The assemblies mounted on each vertical frame shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the TGB.

3.3.6 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes, where the cable is pulled through without a sheath opening, bonds are not required. Attach the shields of spliced cables to the bonding ribbon. Manholes and communications cables within manholes shall be grounded in accordance with Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS Bull 1753F-201:

a. Shield continuity.

b. Conductor continuity.

c. Conductor insulation resistance.

d. Structural return loss.

e. Cable insertion loss and loss margin at carrier frequencies.

f. Shield ground for single jacketed cables.

g. DC loop resistance.

3.5.2 Fiber Optic Cable

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multi-mode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

3.5.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 1 km minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector

signature. The OTDR test shall be conducted in accordance with EIA TIA/EIA-455-81B for single-mode fiber and EIA ANSI/EIA/TIA-455-78A for multi-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multi-mode fiber.

3.5.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1300 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA ANSI/EIA/TIA-455-53A.

3.5.2.3 Bandwidth Test

The end-to-end bandwidth of all multi-mode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA ANSI/EIA/TIA-455-30B.

-- End of Section --

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SECTION 16751

CLOSED CIRCUIT TELEVISION SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA 170	(1957) Electrical Performance Standards - Monochrome Television Studio Facilities
EIA ANSI/EIA-310-D	(1992) Racks, Panels, and Associated Equipment
EIA ANSI/EIA-375-A	(1974) Direct View Monochrome Closed Circuit Television Monitors 525/60 Interlaced 2:1
EIA ANSI/EIA/TIA-232-F	(2002) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 142	(1992) Recommended Practice for Grounding of Industrial and Commercial Power Systems - Green Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

1.2 SYSTEM DESCRIPTION

1.2.1 General

The Contractor shall configure the system as described and shown. All television equipment shall conform to EIA 170 specifications. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Contractor shall also supply all cabling necessary to interconnect the closed circuit television (CCTV) equipment installed in the Security Center, and interconnect equipment installed at remote control/monitoring stations. If the CCTV system is installed for use with an Electronic Security System (ESS) the Contractor shall interface the CCTV system with the ESS.

1.2.2 System Overall Reliability Requirement

The system, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF) of at least 10,000 hours, and shall be calculated based on the configuration specified in paragraph "System Overall Reliability Calculations."

1.2.3 Power Line Surge Protection

All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used for surge protection.

1.2.4 Video and Sync Signal Transmission Line Surge Protection

All cable, except fiber optic cable, used for sync or video signal transmission shall include protective devices to safeguard the CCTV equipment against surges. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. The surge suppression device shall be capable of dissipating not less than 1500 watts for 1 millisecond, and the response time from zero volts to clamping shall not be greater than 5 nanoseconds. Fuses shall not be used for surge protection.

1.2.5 Control Line Surge Protection

All cables and conductors, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against surges and shall have surge protection installed at each end. Protection shall be furnished at the equipment and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 1 m of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond rise time by 20 microsecond pulse width waveform

with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.2.6 Power Line Conditioners

A power line conditioner shall be furnished for the security console CCTV equipment. The power line conditioner shall be of the ferroresonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioner shall be sized for 125 percent of the actual connected kVA load. Characteristics of the power line conditioner shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

1.2.7 Video and Control Signal Data Transmission Media

The Contractor shall provide a video signal transmission system as specified in Section 16415.

1.2.8 Environmental Conditions

1.2.8.1 Field Equipment

The cameras and all other field equipment shall be rated for continuous operation under ambient environmental conditions of minus 10.0 degrees C to 55 degrees C (14 degrees to 131 degrees F) using no auxiliary heating or cooling equipment. Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, wind loading, ice loading, and vibration conditions specified or encountered for the installed location.

1.2.8.2 Security Center Equipment

Security Center and remote control/monitoring station equipment shall, unless designated otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 degrees C to 29.4 degrees C (60 degrees F to 85 degrees F) and a relative humidity of 20 to 80 percent.

1.2.9 Electrical Requirements

Electrically powered IDS equipment shall operate on 120 or 240 volt 60 Hz AC sources as shown. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line

frequency of plus or minus 2 percent with no degradation of performance.

1.3 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE

All items of computer software and technical data (including technical data which relates to computer software), which are specifically identified in this specification shall be delivered strictly in accordance with the CONTRACT CLAUSES, SPECIAL CONTRACT REQUIREMENTS, Section 01330 SUBMITTAL PROCEDURES, and in accordance with the Contract Data Requirements List (CDRL), DD Form 1423, which is attached to and thereby made a part of this contract. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished.

1.3.1 Group I Technical Data Package

1.3.1.1 System Drawings

The data package shall include the following:

a. System block diagram.

b. CCTV system console installation, block diagrams, and wiring diagrams.

c. Security center CCTV equipment installation, interconnection with console equipment, block diagrams and wiring diagrams.

d. Camera wiring and installation drawings.

e. Pan/tilt mount wiring and installation drawings.

f. Interconnection with video signal transmission system, block diagrams and wiring diagrams.

g. Surge protection device installation.

i. Details of interconnection with ESS.

1.3.1.2 Manufacturers' Data

The data package shall include manufacturers' data for all materials and equipment and security center equipment provided under this specification.

1.3.1.3 System Description and Analyses

The data package shall include complete system descriptions, analyses and calculations used in sizing the equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance of this specification. The data package shall include the following:

a. Switcher matrix size.

b. Camera call-up response time.

c. System start up and shutdown operations.

d. Switcher programming instructions.

e. Switcher operating and maintenance instructions.

f. Manuals for CCTV equipment.

g. Data entry forms.

1.3.1.4 Software Data

The data package shall consist of descriptions of the operation and capability of system and application software as specified.

1.3.1.5 Overall System Reliability Calculations

The data package shall include all manufacturer's reliability data and calculations required to show compliance with the specified reliability. The calculations shall be based on all CCTV equipment associated with one camera circuit and the console CCTV equipment, excluding the data transmission media (DTM).

1.3.1.6 Certifications

All specified manufacturer's certifications shall be included with the data package.

1.3.2 Group II Technical Data Package

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall submit a report to the Government documenting changes to the site, or conditions that affect performance of the system to be installed. For those changes or conditions which affect system installation or performance, provide (with the report) specification sheets, or written functional requirements to support the findings, and a cost estimate to correct the deficiency. The Contractor shall not correct any deficiency without written permission from the Government.

1.3.3 Group IV Technical Data Package

The Contractor shall prepare test procedures and reports for the performance verification test . The Contractor shall deliver the performance verification test and endurance test procedures to the Government for approval. After receipt by the Contractor of written approval of the test procedures, the Contractor may schedule the tests. The contractor shall provide a report detailing the results of the field test and a video tape as specified in paragraph "Contractor's Field Testing." The final performance verification and endurance test report shall be delivered after completion of the tests.

1.3.3.1 Operation and Maintenance Manuals

A draft copy of the operation and maintenance manuals, as specified for the Group V technical data package, shall be delivered to the Government prior to beginning the performance verification test for use during site testing.

1.3.3.2 Data Entry

The Contractor shall enter all data needed to make the system operational. The Contractor shall deliver the data to the Government on data entry forms, utilizing data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession required for complete installation of the data base. The Contractor shall identify and request from the Government, any additional data needed to provide a complete and operational CCTV system. The completed forms shall be delivered to the Government for review and approval at least 90 days prior to the Contractor's scheduled need date.

1.3.4 Group V Technical Data Package

Two final copies of each of the manufacturer's commercial manuals arranged as specified bound in hardback, loose-leaf binders, shall be delivered to the Government within 30 days after completing the endurance test. The draft copy used during site testing shall be updated prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance.

1.3.4.1 Functional Design Manual

The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes.

1.3.4.2 Hardware Manual

A manual shall describe all equipment furnished, including:

a. General hardware description and specifications.

b. Installation and checkout procedures.

c. Equipment electrical schematics and layout drawings.

d. System schematics and wiring lists.

e. System setup procedures.

f. Manufacturer's repair parts list indicating sources of supply.

g. Interface definition.

1.3.4.3 Software Manual

The software manual shall describe the functions of all software, and shall include all other information necessary to enable proper loading, testing and operation, including:

a. Definitions of terms and functions.

b. Procedures for system boot-up.

c. Description of using the programs.

d. Description of required operational sequences.

e. Directory of all disk files.

f. Description of all communications protocols, including data formats, command characters, and a sample of each type of data transfer.

1.3.4.4 Operator's Manual

The operator's manual shall explain all procedures and instructions for operation of the system including:

a. Video switcher.

b. Video multiplexer.

c. Cameras and video recording equipment.

d. Use of the software.

e. Operator commands.

f. System start-up and shut-down procedures.

g. Recovery and restart procedures.

1.3.4.5 Maintenance Manual

The maintenance manual shall describe maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.3.4.6 As-Built Drawings

The Contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the CCTV system to be used for as-built drawings. This set shall be accurately kept up to date by the Contractor

with all changes and additions to the CCTV system and shall be delivered to the Government with the final endurance test report. In addition to being complete and accurate, this set of drawings shall be kept neat and shall not be used for installation purposes. Upon completion of the final system drawings, a representative of the Government will review the final system work with the Contractor. If the final system work is not complete, the Contractor will be so advised and shall complete the work as required. Final drawings submitted with the endurance test report shall be finished drawings on mylar or vellum, and as AutoCAD or Microstation files on CD-ROM.

1.4 TESTING

1.4.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed CCTV system. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.4.2 Test Procedures and Reports

Test procedures shall explain, in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

1.5 TRAINING

1.5.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the CCTV system as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional manuals delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor is responsible for furnishing all audio-visual equipment and all other training materials and supplies. Where the Contractor presents portions of the course through the use of audio-visual material, copies of the audio-visual materials shall be delivered to the Government, either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is 8 hours of instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the facility. For guidance in planning the required instruction, the Contractor should assume the attendees will have a high school education or equivalent. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.5.2 Operator's Training

The course shall be taught at the project site for five consecutive training days during or after the Contractor's field testing. A maximum of 12 personnel will attend the course. No part of the training given during this course will be counted toward completion of the performance verification test. The course shall consist of classroom instruction, hands-on training, instruction on the specific hardware configuration of the installed system, and specific instructions for operating the installed system. The course shall demonstrate system start up, system operation, system shutdown, system recovery after a failure, the specific hardware configuration, and operation of the system and its software. The students should have no unanswered questions regarding operation of the installed CCTV system. The Contractor shall prepare and insert additional training material in the training manuals when the need for additional material becomes apparent during instruction. The Contractor shall prepare a written report after the completion of the course. The Contractor shall list in the report the times, dates, attendees and material covered at each training session. The Contractor shall submit the report before the end of the performance verification test. The course shall include:

a. General CCTV hardware, installed system architecture and configuration.

b. Functional operation of the installed system and software.

c. Operator commands.

d. Fault diagnostics and correction.

e. General system maintenance.

f. Replacement of failed components and integration of replacement components into the operating CCTV system.

1.6 MAINTENANCE AND SERVICE

1.6.1 General Requirements

The Contractor shall provide all services required and equipment necessary to maintain the entire CCTV system in an operational state as specified for a period of 1 year after completion of the endurance test, and shall provide all necessary material required for the work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other unscheduled work.

1.6.2 Description of Work

The adjustment and repair of the CCTV system includes all computer equipment, software updates, signal transmission equipment, and video equipment. Provide the manufacturer's required adjustments and all other work necessary.

1.6.3 Personnel

Service personnel shall be qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.6.4 Schedule of Work

The Contractor shall perform two inspections at 6-month intervals or less. This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays. These inspections shall include:

a. Visual checks and operational tests of the CPU, switcher, peripheral equipment, interface panels, recording devices, monitors, video equipment electrical and mechanical controls, and a check of the picture quality from each camera.

b. Run system software and correct all diagnosed problems.

c. Resolve any previous outstanding problems.

1.6.5 Emergency Service

The Government will initiate service calls when the CCTV system is not functioning properly. Qualified personnel shall be available to provide service to the complete CCTV system. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at the site within 24 hours after receiving a request for service. The CCTV system shall be restored to proper operating condition within 3 calendar days after receiving a request for service.

1.6.6 Operation

Performance of scheduled adjustments and repair shall verify operation of the CCTV system as demonstrated by the applicable portions of the performance verification test.

1.6.7 Records and Logs

The Contractor shall keep records and logs of each task, and shall organize cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain calibration, repair, and programming data. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the CCTV system.

1.6.8 Work Requests

The Contractor shall separately record each service call request, as received. The form shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the

materials to be used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within 5 days after work is completed.

1.6.9 System Modifications

The Contractor shall make any recommendations for system modification in writing to the Government. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the systems shall be incorporated into the operations and maintenance manuals, and other documentation affected.

1.6.10 Software

The Contractor shall recommend all software updates to the Government for approval. Upon Government approval, updates shall be accomplished in a timely manner, fully coordinated with the CCTV system operators, operation in the system verified, and shall be incorporated into the operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the manufacturer's software.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

All system hardware and software components shall be produced by manufacturers regularly engaged in the production of CCTV equipment. Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Equipment located at the security center or a remote control/monitoring station shall be rack mounted as shown. Both Television and Computing devices shall comply with 47 CFR 15, Subpart B.

2.1.1 Soldering

All soldering shall be done in accordance with standard industry practices.

2.2 ENCLOSURES

The Contractor shall provide metallic enclosures as needed for equipment not housed in racks or supplied with a housing. The enclosures shall be as specified or shown.

2.2.1 Interior

Enclosures to house equipment in an interior environment shall meet the requirements of NEMA 250 Type 12.

2.3 LOCKS AND KEY-LOCK OPERATED SWITCHES

2.3.1 Locks

Locks shall be provided on system enclosures for maintenance purposes shall be conventional key type lock having a combination of five cylinder pin and five-point three position side bar. Keys shall be stamped "U.S. GOVT. DO NOT DUP." The locks shall be so arranged that the key can only be withdrawn when in the locked position. All maintenance locks shall be keyed alike and only two keys shall be furnished for all of these locks.

2.4 SOLID STATE CAMERAS

2.4.1 High Resolution Color Camera

All electronic components and circuits shall be solid state. Signal-to-noise ratio shall not be less than 50 dB unweighted. The camera shall exhibit no geometric distortion. The lens mount shall be a C-mount, and the camera shall have a back focus adjustment. The camera shall operate from 10 to 55 degrees C without auxiliary heating or cooling, and with no change in picture quality or resolution. The camera shall operate on 60 Hz AC power, and shall be capable of operating at a voltage of 105 to 130 Volts.

2.4.1.1 Solid State Image Array

The camera shall have a solid state imaging array, and the picture produced by the camera shall be free of blemishes as defined by EIA 330. The camera shall provide not less than 460 lines of horizontal resolution, and resolution shall not vary over the life of the camera. The imager shall have at least 768 horizontal x 494 vertical active picture elements.

2.4.1.2 Sensitivity

Camera shall provide full video output with the infrared cut-off filter installed, without camera automatic gain, and a scene reflectivity of 75 percent using an f/1.2 lens given a camera faceplate illumination at 3200K of 0.2 lux (0.2 footcandle) minimum.

2.4.1.3 Camera Synchronization

The camera shall have an input for external sync, and shall automatically switch over to internal sync if external sync is not present. The camera shall also have the capability of synchronization by line-locking to the AC power line frequency at the zero crossing point, and shall provide not less than plus or minus 90 degrees of vertical phase adjustment.

2.4.1.4 Connectors

Cameras with lenses having auto iris, manual iris, or zoom and focus functions shall be supplied with connectors and wiring as needed to operate the lens functions. Video signal output connector shall be a BNC. Cameras with integral fiber optic video transmitters shall have straight-tip bayonet type fiber optic video output connectors. A connector shall be provided for external sync input.

2.4.1.5 Automatic Circuits

The camera shall have circuitry for through the lens (TTL) white balancing, fixed white balancing, and automatic gain control.

2.5 CAMERA LENSES

Camera lenses shall be all glass with coated optics. The lens mount shall be a C or CS mount, compatible with the cameras selected. The lens shall be supplied with the camera, and shall have a maximum f-stop opening of f/1.2 or the maximum available for the focal length specified. The lens shall be equipped with an auto-iris mechanism unless otherwise specified. Lenses having auto iris, manual iris, or zoom and focus functions shall be supplied with connectors, wiring, receiver/drivers, and controls as needed to operate the lens functions. Lenses shall have sufficient circle of illumination to cover the image sensor evenly. Lenses shall not be used on a camera with an image format larger than the lens is designed to cover. Lens focal lengths shall be as shown or specified in the manufacturer's lens selection tables.

2.6 CAMERA HOUSINGS AND MOUNTS

The camera and lens shall be enclosed in a tamper resistant housing as specified below. Any ancillary housing mounting hardware needed to install the housing at the camera location shall be provided as part of the housing. The camera and lens contained in a camera housing shall be installed on a camera support as shown. Any ancillary mounting hardware needed to install the support and to install the camera on the support shall be provided as part of the support. The camera support shall be capable of supporting the equipment to be mounted on it including wind and ice loading normally encountered at the site.

2.6.1 Indoor Camera Housing

The housing shall be designed to provide a tamper resistant enclosure for indoor camera operation. The housing shall be equipped with tamper proof latches, and shall be supplied with the proper mounting brackets for the specified camera and lens. The housing and appurtenances shall be a color that does not conflict with the building interior color scheme.

2.6.2 Interior Mount

The camera mount shall be suitable for either wall or ceiling mounting and shall have an adjustable head for mounting the camera. The wall mount and head shall be constructed of aluminum or steel with a corrosion-resistant finish. The head shall be adjustable for 360 degrees of pan, and not less than 90 degrees of tilt.

2.6.3 Pan/Tilt Mount

The pan/tilt mount shall be capable of supporting the camera, lens and housing specified. If the pan/tilt is to be mounted outdoors, the pan/tilt shall be weatherproof, and sized to accommodate the camera, lens and

housing weight plus maximum wind loading encountered at the installation site. The pan/tilt shall have heavy duty bearings, hardened steel gears, externally adjustable limit stops for pan and tilt, and mechanical, dynamic or friction brakes. Pan/tilt shall be permanently lubricated. The motors shall be thermally or impedance protected against overload damage. Pan movement shall not be less than 0 to 350 degrees, tilt movement shall not be less than plus and minus 90 degrees. Pan speed shall not be less than 6 degrees per second, and tilt speed shall not be less than 3 degrees per second. The pan/tilt shall be supplied complete with wiring, wiring harnesses, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to provide a fully functional pan/tilt mount to fulfill the site design requirements.

2.7 VIDEO MONITOR

2.7.1 Color Video Monitor

All electronic components and circuits shall be solid state except for the picture tube. The monitor shall have a stabilized high voltage power supply, and regulated low voltage power supplies. The monitor shall have automatic frequency control (AFC) and horizontal resolution not less than 280 lines at the center of the picture tube. The video input shall allow switchable loop-through or 75 ohm termination. The monitor shall have circuitry for automatic degaussing. The monitor shall operate on 60 Hz AC power, and shall be capable of operating at a voltage of 105 to 130 Volts.

2.7.2 Picture Tube

The monitor shall have a 230 mm picture tube measured diagonally.

2.7.3 Configuration

The monitor shall be configured in a rack mount. The rack mount shall fit in a standard EIA 482.6 mm (19 inch) rack as described in EIA ANSI/EIA-310-D. Monitors shall not interfere with each other when rack mounted or operated next to each other as described in EIA ANSI/EIA-375-A.

2.7.4 Controls

Front panel controls shall be provided for power on/off, horizontal hold, vertical hold, contrast, and brightness. The monitor shall have switchable DC restoration.

2.7.5 Connectors for Video Monitor

Video signal input and output shall be by BNC connectors.

2.8 VIDEO SWITCHER

The switcher shall conform to EIA 170 specifications, and shall be a vertical interval switcher. Electronic components, subassemblies, and circuits of the switcher shall be solid state. The switcher shall be microprocessor based and software programmable. The switcher shall be a

modular system that shall allow for expansion or modification of inputs, outputs, alarm interfaces, and secondary control stations by addition of the appropriate modules. Switcher components shall operate on 120 volts 60 Hz AC power. The switcher central processor unit shall be capable of being interfaced to a master security computer for integrated operation and control. The video switcher central processing unit (CPU) shall have the capability of accepting time from a master clock supplied in ASCII format through an EIA ANSI/EIA/TIA-232-F input. All components, modules, cables, power supplies, software, and other items needed for a complete and operable CCTV switching system shall be provided. Switcher equipment shall be rack mounted unless otherwise specified. Rack mount hardware shall be supplied to mount the switcher components in a standard 482.6 mm (19 inch) rack as described in EIA ANSI/EIA-310-D.

2.8.1 Switcher Software

The switcher shall be software programmable, and the software shall be supplied as part of the switcher. The software shall be installed in the switcher CPU, and shall be configured as required by the site design. Changes or alterations of features under software control shall be accomplished through software programming without changes in hardware or system configuration. The switcher shall retain the current program for at least 6 hours in the event of power loss, and shall not require reprogramming in order to restart the system.

2.8.2 Switcher Matrix

The switcher shall be a programmable crosspoint switcher capable of switching any video input to any video output. The switcher to be installed at the site shall be configured to switch 5 cameras to 2 monitors, and shall have an expansion capability of not less than 50 percent.

2.8.3 Switcher Modular Expansion

The switcher shall be expandable in minimum increments as specified below.

2.8.3.1 Input Module

Hardware expansion modules shall be provided to expand the switcher matrix configuration in increments of at least 8 camera inputs.

2.8.3.2 Output Module

Hardware expansion modules shall be provided to expand the switcher matrix configuration in increments of at least 4 video outputs.

2.8.4 Control Keyboards

Control and programming keyboards shall be supplied for the video switcher at the rack, and control keyboards shall be supplied for any control/monitoring stations as shown. The control keyboard shall provide the interface between the operator and the CCTV system, and shall relay commands from the operator to the switcher CPU. The keyboard shall provide

control of the video switcher functions needed for operation and programming of the video switcher. Controls shall include, but not be limited to: programming the switcher, switcher control, lens function control, pan/tilt/zoom (PTZ) control, control of environmental housing accessories, and annotation programming. If the switcher CPU requires an additional text keyboard for system management functions, the keyboard shall be supplied as part of the video switcher.

2.8.5 Accessory Control Equipment

The video switcher shall be equipped with signal distribution units, preposition cards, expansion units, cables, software or any other equipment needed to ensure that the CCTV system is complete and fully operational.

2.8.6 Connectors for Video Switcher

Video signal input and output shall be by BNC connectors.

2.8.7 Video Annotation

Video annotation equipment shall be provided for the video switcher. The annotation shall be alphanumeric and programmable for each video source. Annotation to be generated shall include, but not be limited to: individual video source identification number, time (hour, minute, second) in a 24 hour format, date (month, day, year), and a unique, user-defined title with at least 8 characters. The annotation shall be inserted onto the source video so that both shall appear on a monitor or recording. The lines of annotation shall be movable for horizontal and vertical placement on the video picture. The annotation shall be automatically adjusted for date. Programmed annotation information shall be retained in memory for at least 4 hours in the event of power loss.

2.9 VIDEO MULTIPLEXER

The video multiplexer shall be a multi-channel record and playback system with the capability of monochrome and color real time multi-screen viewing. Electronic components, sub assemblies, and circuits of the multiplexer shall be solid state. The multiplexer, using time division multiplexing, shall permit up to 16 camera inputs to be recorded simultaneously on a single video cassette recorder (VCR). All 16 camera inputs shall be capable of being viewed on a video monitor either live or recorded. The multiplexer shall allow for simultaneous viewing, recording playback, and multiplexing (Duplex Operation). The inputs shall be capable of simultaneous viewing on the monitor or full screen individually and in other multi-screen modes such as 2x2, 3x3, 4x4 or other configurations. The viewing format shall also permit 2x dynamic zoom capability, full screen. The multiplexer shall be compatible with EIA/NTSC video cameras and standard or super VHS VCRs. External camera synchronization shall not be required for proper operation of the video multiplexer. Control of all functions of the multiplexer shall be provided either by a full function keyboard or by pushbutton selection with on-screen menu driven set-up. The multiplexer shall retain the current program for at east 6 hours in the event of power loss.

2.10 VIDEO CASSETTE RECORDER (VCR)

VCR shall conform to EIA 170 standards. The VCR shall be specifically designed as a time lapse recorder for use in security systems. The VCR shall operate on 120 volts 60 Hz AC power. Resolution of the VCR in normal play mode shall not be less than 350 horizontal lines in monochrome, 300 horizontal lines in color. Signal-to-noise ratio shall not be less than 40 dB. The VCR shall have a condensation or dew circuit. The VCR shall have a built-in time and date generator that can be turned on or off, and shall impose the time and date on the video during recording. A 24 hour battery back-up shall be provided to protect time/date and programmed information. The VCR shall have an audible warning alarm that shall annunciate the end of tape, excessive condensation, tape transport malfunction, or tape jam.

2.10.1 Tape and Tape Transport

The video tape used in the recorder shall be contained in a cassette mechanism, and shall not require the operator to thread the tape through the tape transport mechanism. The tape shall load through the front of the recorder.

2.10.2 Recording and Playback

The VCR shall be capable of recording for 168 hours or more on a single cassette tape with at least 6 user selectable time-lapse record speeds. The VCR shall have a contact closure alarm signal input which shall automatically switch the recorder into standard play, record mode when an alarm is initiated. The recorder shall reach stabilized record speed in 1 second or less. The VCR shall put a cue mark on the tape at the beginning of an alarm event recording. The alarm event record time shall be selectable for up to 3 minutes of automatic recording as a minimum. A record-lock feature shall be provided which shall protect the VCR against tampering with the tape transport controls and power control once recording has started. Playback functions shall include: alarm search, fast forward search, fast rewind search, rewind/fast forward, play, slow motion or step field/frame, and pause/still.

2.10.3 Connectors for VCR

Video signal input and output shall be by BNC connectors. The recorder shall provide connectors for alarm trigger signal input and output.

2.11 VIDEO SIGNAL EQUIPMENT

The following video signal equipment shall conform to EIA 170. Electrically powered equipment shall operate on 120 Volts 60 Hz AC power. All video signal inputs and outputs shall be by BNC connectors.

2.11.1 Ground Loop Corrector

The ground loop corrector shall eliminate the measured ground loop interference (common mode voltage) in wireline or coaxial video transmission lines. The ground loop corrector shall pass the full transmitted video bandwidth with no signal attenuation or loss. Clamping

ground loop correctors shall be capable of rejecting at least an 8 volt peak-to-peak 60 Hz common mode signal. Ground isolation transformers shall be capable of rejecting at least a 10 volt peak-to-peak 60 Hz common mode signal. Ground isolation amplifiers shall be capable of rejecting at least a 30 volt peak-to-peak 60 Hz common mode signal. Differential ground loop correctors shall be capable of rejecting at least a 100 volt peak-to-peak 60 Hz common mode signal.

2.11.2 Video Equalizing Amplifier

The video equalizing amplifier shall be designed to correct loss in video signal level and high frequency attenuation caused by long distance video signal transmission over wireline DTM. The amplifier shall have independent signal gain and equalization controls. The amplifier shall be capable of equalizing at least 900 m (3000 feet) of RG-11/U coaxial cable conforming to paragraph CCTV Equipment Video Signal Wiring. The amplifier shall provide a minimum of plus or minus 6 dB of video gain and 12 dB of high frequency compensation. At least one video output shall be provided for each video input. Bandwidth shall be 10 MHz or greater, and frequency response to 8 MHz shall be plus or minus 1 dB or less. Hum and noise shall be 50 dB below 1 volt peak-to-peak or better. Video inputs shall be 75 ohm unbalanced, terminating, differential grounded. Video outputs shall be 75 ohm, differential, source terminated, 1 volt peak-to-peak. Output isolation shall be 40 dB or greater at 5 MHz.

2.11.3 Video Distribution Amplifier

The video distribution amplifier shall be designed to distribute a single, 75 ohm, unbalanced video input signal to a minimum of 4, 75 ohm, source terminated video outputs. The distribution amplifier shall have not less than plus or minus 3 dB of gain adjustment for the video output. Output isolation shall be 40 dB or greater at 5 MHz. Bandwidth shall be 10 MHz or greater, and frequency response to 8 MHz shall be plus or minus 0.5 dB or less. Hum and noise shall be 55 dB below 1 volt peak-to-peak or better.

2.11.4 Master Video Sync Generator

The master video sync generator shall generate horizontal drive, vertical drive, blanking, and sync signals as a minimum, with at least one 75 ohm output provided for each signal. The master oscillator crystal shall be pre-aged, and temperature stabilized, ovenized or temperature compensated. The sync generator shall have a composite video input and shall lock to the incoming video signal. If no video is present at the video input, the sync generator shall switch to internal crystal control. Not less than 2.5 microseconds advance and 2.5 microseconds delay of horizontal phase shall be provided. Vertical blanking width adjustment shall be provided. Vertical blanking width adjustment shall have a minimum selection range of 19, 20, and 21 lines.

2.11.5 Video Sync Distribution Amplifier

The sync distribution amplifier shall be a regenerative amplifier designed to distribute a sync signal input to not less than 6, 75 ohm outputs. Output level shall remain constant and shall not be affected by input level

variations. Output isolation shall be greater than 35 dB at 5 MHz. A high impedance loop through shall be provided in addition to the 6 outputs. The distribution amplifier shall have continuously variable delay range of at least 250 nanoseconds to 2.2 microseconds. The delay shall be adjustable through a front panel control.

2.12 ACCESSORIES

Standard 482.6 mm (19 inch) electronic rack cabinets conforming to EIA ANSI/EIA-310-D shall be provided for the CCTV system at the security center and remote control/monitoring sites as shown.

2.13 WIRE AND CABLE

The Contractor shall provide all wire and cable not indicated as Government Furnished Equipment. All wire and cable components shall be able to withstand the environment the wire or cable is installed in for a minimum of 20 years.

2.13.1 CCTV Equipment Video Signal Wiring

The coaxial cable shall have a characteristic impedance of 75 ohms plus or minus 3 ohms. RG 6/U coaxial cable shall have shielding which provides a minimum of 95 percent coverage, with center conductor of 18 AWG or larger polyethylene insulation, and a black non-contaminating polyvinylchloride (PVC) jacket.

2.13.2 Low Voltage Control Wiring

Twisted pair low voltage control wiring shall be provided as described in Section 16792 WIRE LINE DATA TRANSMISSION SYSTEM. Plenum or riser cables shall be IEEE C2 CL2P certified.

2.14 PREDELIVERY TESTING

2.14.1 General

The Contractor shall assemble the test CCTV system as specified, and perform tests to demonstrate that the performance of the system complies with the contract requirements in accordance with the approved predelivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during predelivery testing, including results of each test procedure, shall be delivered to the Government at the conclusion of predelivery testing prior to Government approval of the test. The test report shall be arranged so that all commands, stimuli, and responses are correlated to allow logical interpretation.

2.14.2 Test Setup

The Contractor shall provide the equipment needed for the test setup and shall configure it to provide alarm actuated camera call-up and alarm recording as required to emulate the installed system. The test setup

shall consist of at least 4 complete camera circuits. The alarm signal input to the CCTV test setup shall be by the same method that is used in the installed system. The video switcher shall be capable of switching any camera to any monitor and any combination of cameras to any combination of monitors. The minimum test setup shall include:

a. Four video cameras and lenses, including dome cameras if required for the installed system.

b. Three video monitors.

c. Video recorder if it is required for the installed system.

d. Video switcher including video input modules, video output modules, and control and applications software.

e. Video multiplexer, if required for the installed system.

h. Any ancillary equipment associated with a camera circuit such as equalizing amplifiers, video loss/presence detectors, terminators, ground loop correctors, surge protectors or other in-line video devices.

i. Cabling for all components.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, IEEE C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system. Raceways shall be furnished and installed as specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and Section 16415 ELECTRICAL WORK, INTERIOR. DTM shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. All other electrical work shall be as specified in the above sections including grounding to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.1 Current Site Conditions

The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government in a report as defined in paragraph Group II Technical Data Package. The Contractor shall not take any corrective action without written permission from the Government.

3.1.2 Existing Equipment

The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as shown. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Government approval. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the CCTV system, and furnish a report to the Government as part of the site survey report as defined in paragraph "Group II Technical Data Package." For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include the scheduled need date for connection to all existing equipment. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Government approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment. The Government is responsible for maintenance and repair of Government equipment. The Contractor shall be held responsible for repair costs due to Contractor negligence or abuse of Government equipment.

3.1.3 Enclosure Penetrations

All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.1.4 Cold Galvanizing

All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.1.5 Interconnection of Console Video Equipment

The Contractor shall connect signal paths between video equipment with RG-6/U coaxial cable. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.

3.1.6 Cameras

The Contractor shall install the cameras with the proper focal length lens as indicated for each zone; connect power and signal lines to the camera; set cameras with fixed iris lenses to the proper f-stop to give full video level; aim camera to give field of view as needed to cover the alarm zone;

aim fixed mount cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun; focus the lens to give a sharp picture over the entire field of view; and synchronize all cameras so the picture does not roll on the monitor when cameras are selected. Dome cameras shall have all preset positions defined and installed.

3.1.7 Monitors

The Contractor shall install the monitors as shown and specified; connect all signal inputs and outputs as shown and specified; terminate video input signals as required; and connect the monitor to AC power.

3.1.8 Switcher

The Contractor shall install the switcher as shown and according to manufacturer's instructions; connect all subassemblies as specified by the manufacturer and as shown; connect video signal inputs and outputs as shown and specified; terminate video inputs as required; connect alarm signal inputs and outputs as shown and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by the manufacturer and as shown; connect the switcher CPU and switcher subassemblies to AC power; load all software as specified and required for an operational CCTV system configured for the site requirements, including data bases, operational parameters, and system, command, and application programs; provide the original and 2 backup copies for all accepted software upon successful completion of the endurance test; and program the video annotation for each camera.

3.1.9 Video Recording Equipment

The Contractor shall install the video recording equipment as shown and as specified by the manufacturer; connect video signal inputs and outputs as shown and specified; connect alarm signal inputs and outputs as shown and specified; and connect video recording equipment to AC power.

3.1.10 Video Signal Equipment

The Contractor shall install the video signal equipment as specified by the manufacturer and as shown; connect video or signal inputs and outputs as shown and specified; terminate video inputs as required; connect alarm signal inputs and outputs as required; connect control signal inputs and outputs as required; and connect electrically powered equipment to AC power.

3.1.11 Camera Housings, Mounts, and Poles

The Contractor shall install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera; provide electrical and signal transmission cabling to the mount location as specified in Section 16415; connect signal lines and AC power to mount interfaces; and connect pole wiring harness to camera.

3.2 SYSTEM STARTUP

The Contractor shall not apply power to the CCTV system until the following items have been completed:

a. CCTV system equipment items and DTM have been set up in accordance with manufacturer's instructions.

b. A visual inspection of the CCTV system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

c. System wiring has been tested and verified as correctly connected as indicated.

d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.

e. Power supplies to be connected to the CCTV system have been verified as the correct voltage, phasing, and frequency as indicated.

f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.3 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL

The following requirements supplement the contractor quality control requirements specified elsewhere in the contract. The contractor shall provide the services of technical representatives who are thoroughly familiar with all components and installation procedures of the installed IDS; and are approved by the Contracting Officer. These representatives will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance. These representatives shall also be available on an as needed basis to provide assistance with follow-up phases of quality control. These technical representatives shall participate in the testing and validation of the system and shall provide certification that their respective system portions meet its contractual requirements.

3.4 SITE TESTING

3.4.1 General

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness all performance verification and endurance testing. Written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test.

3.4.2 Contractor's Field Testing

The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. In addition, the Contractor shall make a master video tape recording showing typical day and night views of each camera in the system and shall deliver the tape with the report. Note any objects in the field of view that might produce highlights that could cause camera blinding. Note any objects in the field of view or anomalies in the terrain which may cause blind spots. Note if a camera cannot be aimed to cover the zone and exclude the rising or setting sun from the picture. Note night assessment capabilities and whether lights or vehicle headlights cause blooming or picture degradation. If any of the above conditions or other conditions exist that cause picture degradation or interfere with the camera field of view, the Contractor shall inform the Contracting Officer. The tape shall be recorded using the video recorder installed as part of the CCTV system. If a recorder is not part of the CCTV system, the Contractor shall provide the tape in Video Home System (VHS) format. The Contractor shall provide the Government with the original tape as part of the documentation of the system and shall submit a letter certifying that the CCTV system is ready for performance verification testing. The field testing shall as a minimum include:

a. Verification that the video transmission system and any signal or control cabling have been installed, tested, and approved as specified.

c. Verification that the switcher is fully functional and that the switcher software has been programmed as needed for the site configuration.

d. Verification that switcher software is functioning correctly. All software functions shall be exercised.

e. Verification that video multiplexers are functioning correctly.

f. Operation of all electrical and mechanical switcher controls and verification that the control performs the designed function.

g. Verification that all video sources and video outputs provide a full bandwidth signal that complies with EIA 170 at all video inputs.

h. Verification that all video signals are terminated properly.

i. Verification that all cameras are aimed and focused properly. The Contractor shall conduct a walk test of the area covered by each camera to verify the field of view.

l. Verification that all cameras are synchronized and that the picture does not roll when cameras are switched.

The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.4.3 Performance Verification Test

The Contractor shall demonstrate that the completed CCTV system complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the Government, based on the Contractor's written report. This shall include certification of successful completion of Contractor Field Testing as specified in paragraph "Contractor's Field Testing," and upon successful completion of training as specified. Upon successful completion of the performance verification test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to commencing the endurance test.

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SECTION 16770

RADIO AND PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA-310-D	(1992) Racks, Panels, and Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1449	(1996; Rev thru Jul 2002) Transient Voltage Surge Suppressors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G
Detail drawings as specified.

SD-03 Product Data

Spare Parts

Spare parts data for each different item of material and equipment specified.

SD-06 Test Reports

Approved Test Procedures; G
Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

SD-07 Certificates

Components

Copies of current approvals or listings issued by UL, or other nationally recognized testing laboratory for all components.

SD-10 Operation and Maintenance Data

Radio and Public Address System

Submit Data Package 3 in accordance with Section 01701 OPERATIONS AND MAINTENANCE MANUALS

1.3 SYSTEM DESCRIPTION

The radio and public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and ancillary components required to meet the required system configuration and operation.

1.3.1 Multi-Channel System with Paging

The system shall include microphones, microphone outlet receptacles, microphone inputs with preamplifiers, inputs for film sound, compact disc, magnetic tape, and program sources, all channel paging, control for each input, power amplifying equipment, and accessories required to output the public address and paging audio signals through selected portions of the audio distribution network as indicated.

1.3.2 System Performance

The system shall provide even sound distribution throughout the designated

area, plus or minus 3 dB for the 1/1 octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newtons per square meter).

1.3.3 Detail Drawings

The Contractor shall submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical speakers. The Contractor shall check the layout based on the actual speakers to be installed and make necessary revisions in the detail drawings. Detail drawings shall also contain complete point to point wiring, schematic diagrams and other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.3.4 Spare Parts

The Contractor shall submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

1.4 DELIVERY AND STORAGE

Equipment placed in storage until installation shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

1.5 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment to be provided shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, and shall essentially duplicate material and equipment that have been in satisfactory use at least 2 years. All components used in the system shall be commercial designs that comply with the requirements specified.

Equipment shall be supported by a service organization that is within 60 miles of the site.

2.1.1 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, model and catalog number, and serial number on a plate secured to the equipment.

2.2 POWER AMPLIFIERS

Power amplifiers as a minimum conform to the following specifications:

Rated power output:	125 watts RMS
Frequency Response:	Plus or Minus 3 dB, 20-20,000 Hz
Distortion:	Less than 2 percent at RPO, 600-13,000 Hz
Input Impedance:	50 k ohm unbalanced
Output Impedance:	Balanced 4 and 8 ohms
Output voltage:	25 and 70.7 volts
Power Requirement:	110-125 Vac 60 Hz

2.3 MIXER AMPLIFIER

Mixer amplifier shall as a minimum conform to the following specifications:

Rated Power Output (RPO):	125 watts RMS
Frequency Response:	Plus or Minus 3 dB, 20-20,000 Hz
Distortion:	Less than 1% at RPO, 60 - 13,000 Hz
Inputs:	2 microphones (high impedance or low-impedance unbalanced 4 Aux. (high-impedance)
Output Impedance:	Balanced 4 and 8 ohms
Output Voltage:	25 and 70.7 volts
Power Requirement:	110-125 Vac 60 Hz

2.4 MICROPHONE INPUT MODULES

Microphone input modules shall as a minimum conform to the following specifications:

Rated Outputs:	0.25 volts into 10,000 ohms 1.0 volts into 10,000 ohms
Frequency Response:	Plus or Minus 2 dB, 20 - 20,000 Hz
Distortion:	Less than 0.5 percent 20 - 20,000 Hz
Inputs:	4 transformer - coupled balanced 150 ohm
Input Sensitivity:	0.003 volts
Input Channel Isolation:	70 dB minimum

2.5 MICROPHONES

2.5.1 Desk Microphone

Microphones shall as a minimum conform to the following specifications:

Element:	Dynamic
Pattern:	Cardioid
Frequency Response:	50 - 12,000 Hz
Impedance:	Low impedance mic (150-400 ohms)
Front-to-back Ratio:	20 dB
Selector switches:	Selector switches for zone shall be be separate console adjacent to microphone

2.5.2 Gooseneck Microphone

Gooseneck microphone shall meet the minimum requirements of the desk microphone. Microphone shall have push to talk button. Gooseneck tube length shall be 305 mm .

2.5.3 Microphone Jack

Each outlet for microphones shall consist of a standard outlet box, flush-mounted, and fitted with a three-pole, polarized, locking-type, female microphone jack and a corrosion resistant-steel device plate.

2.6 LOUDSPEAKERS

2.6.1 Cone Speaker

The drawings show rooms that shall receive PA speakers. The contractor shall determine proper spacing and install as required. The cone speaker shall as a minimum conform to the following specifications:

Application:	Wall baffle and Ceiling
Frequency range:	60 to 12,000 Hz
Power Rating:	Normal - 15 watts Peak - 35 watts
Voice Coil Impedance:	8 ohms
Line Matching Transformer Type:	25/ 70.7 volt line
Capacity:	4 watts
Magnet:	10 ounces or greater
Primary Taps:	0.5, 1, 2 and 4 watts
Primary Impedance:	25 volts - 1250, 625, and 312 ohms 70.7 volts - 10k, 5k, and 2.5k ohms
Frequency Response:	30 - 20,000 Hz
Insertion Loss:	Less than 1 dB

2.6.2 Wall Baffle Speaker Enclosures

The wall baffle speaker shall be of particle board construction covered with walnut laminate and complete with black cloth grille. Baffle shall feature 9.5 degree slope to provide directional sound dispersion offset in the direction of radiation. Wall baffle enclosure shall come equipped with a wall mounting bracket designed to assure a rigid mounting to any flat surfaces.

2.6.3 Ceiling Speaker Enclosures

Ceiling speaker enclosure shall be constructed of heavy gauge cold steel with interior undercoating and 38 mm thick high density fiberglass 24 kg per cubic meter . The unit shall be round and designed for recessed installations which will be accomplished via flange mount mounting. Recessed models shall have a rust-preventive, textured black coating and the surface mount unit finished in textured white . Enclosure shall include four triple compound conduit knockouts.

2.7 PRIORITY RELAYS AND CONTROLS

Priority relays and controls required to accomplish operations specified shall be provided. Relays shall be completely enclosed with a plastic dust cover for maximum protection against foreign matter, and shall be plug-in type. Relays shall be provided with a diode wired across the relay coil for transient suppression and shall be installed utilizing factory-prewired, rack-mounted receptacle strips. Coil shall be maximum 24 volts dc.

2.8 SWITCHES AND CONTROLS

2.8.1 Radio System Control Switch

2.8.2 Remote Loudspeaker ON/OFF Switches

Remote switches shall be toggle switch 2-pole, wall-mounted, single gang type with engraved switch plates finished to match the approved finish of electrical wall switches. Low-voltage priority override relays shall be provided as part of the switches with all wiring to the racks to allow override of the ON/OFF switches for priority announcements.

2.8.3 Remote Loudspeaker Volume Controls

Remote volume controls shall be an auto transformer type with detented 3 dB steps and an OFF position. The controls shall be wall-mounted in single-gang outlet boxes and furnished with engraved switching plates finished to match approved finish of electrical wall switches. Insertion loss of the controls shall not exceed 0.6 dB and the power-handling capacities of the control shall be 35 watts. Low-voltage priority override relays shall be furnished as part of these controls with all wiring to the racks to allow override of the volume controls for priority announcements.

2.9 EQUIPMENT RACKS

Equipment shall be mounted on 482.6 mm racks in accordance with EIA ANSI/EIA-310-D and located as shown on drawings. Ventilated rear panels, solid side panels, and solid top panels shall be provided. Equipment racks shall be provided with lockable front panels that limit access to equipment. The lockable front shall not cover items that require operator access such as am/fm tuner, CD player, or tape player. Rack cooling shall be through perforations or louvers in front panels to ensure adequate ventilation of equipment. The racks and panels shall be factory finished with a uniform baked enamel over rust inhibiting primer.

2.10 CABLES

2.10.1 Speaker Cable

Cables shall be of the gauge required depending upon the cable run length. In no case shall cable be used which is smaller than 18 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm . Cables shall be jacketed with a Fluoropolymer compound. The jacket thickness shall be 0.5 mm minimum.

2.10.2 Microphone Cable

Cable conductor shall be stranded copper 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm . Cable shall be shielded 100% of aluminum polyester foil with a bare 22 gauge stranded soft copper drain conductor. Cables shall be jacketed with a Fluoropolymer compound. The jacket thickness shall be 0.5 mm minimum.

2.11 TERMINALS

Terminals shall be solderless, tool-crimped pressure type.

2.12 SURGE PROTECTION

2.12.1 Power Line Surge Protection

Major components of the system such as power amplifiers, mixer-preamplifiers, and tuners, shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground). Surge protection device shall be UL listed and labeled as having been tested in accordance with UL 1449.

2.12.2 SIGNAL SURGE PROTECTION

Major components of the system shall have internal protection circuits which protects the component from mismatched loads, direct current, and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and specified, and in accordance with the manufacturer's recommendations except where otherwise indicated. Equipment mounted out-of-doors or subject to inclement conditions shall be weatherproofed. The antenna shall be supported at least 1.5 m clear above the roof by means of self-supported or guyed mast.

3.1.1 Equipment Racks

Racks shall be mounted side-by-side and bolted together. Items of the same function shall be grouped together, either vertically or side-by-side. Controls shall be symmetrically arranged. Audio input and interconnections shall be made with approved shielded cable and plug connectors; output connections may be screw terminal type. All connections to power supplies shall utilize standard male plug and female receptacle connectors with the female receptacle being the source side of the connection. Inputs,

outputs, interconnections, test points, and relays shall be accessible at the rear of the equipment rack for maintenance and testing. Each item shall be removable from the rack without disturbing other items or connections. Empty space in equipment racks shall be covered by blank panels so that the entire front of the rack is occupied by panels.

3.1.2 Wiring

Wiring shall be installed in rigid steel conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Wiring for microphone, grounding, line level, speaker and power cables shall be isolated from each other by physical isolation and metallic shielding. Shielding shall be terminated at only one end.

3.2 GROUNDING

All grounding practices shall comply with NFPA 70. Equipment shall be grounded to the serving panelboard ground bus through a green grounding conductor. Metallic conduits serving the equipment shall be isolated on the equipment end with an insulating bushing to prevent noise from being transferred to the circuit. Equipment racks shall be grounded to the panelboard ground bus utilizing a #8 conductor. Grounding conductor shall be terminated to the rack using connector suitable for that purpose.

3.3 ACCEPTANCE TESTS

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 14 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or nondesignated units.

3.4 TRAINING

The Contractor shall conduct a training course for 4 members of the operating and maintenance staff as designated by the Contracting Officer. The training course will be given at the installation during normal working hours for a total of 8 hours and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance manuals, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to the start of the training course.

-- End of Section --

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SECTION 16772

MASS NOTIFICATION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

Standard 60849	(Second Edition: 1998) Sound Systems for Emergency Purposes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code

UNDERWRITERS LABORATORIES (UL)

UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1971	(1995; Rev thru Apr 1999) Signaling Devices for the Hearing Impaired
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 797	(2000; Rev thru May 2003) Electrical Metallic Tubing - Steel
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Mass Notification System; G

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-O3 Product Data

Spare Parts;

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Storage Batteries;

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop;

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts;

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G

Technical data which relates to computer software.

Training;

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the mass

notification system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing; G

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 or 4 Fire Alarm or Audio Technician, for the mass notification system 60 days prior to performing system tests.

SD-06 Test Reports

Test Procedures; G

Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests; G

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

SD-07 Certificates

Equipment;

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications; G

Proof of qualifications for required personnel. The installation contractor shall submit proof of experience for the Professional Engineer, fire alarm or audio technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G

Six copies of operating manual outlining step-by-step procedures

required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The mass notification system shall be configured in accordance with UFC 4-021-01 and applicable parts of NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems or audio systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm or Audio Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the mass notification system. NICET Level 2 or higher Fire Alarm or Audio Technician shall install and terminate mass notification devices, cabinets and panels. An electrician or NICET Level 2 Fire Alarm or Audio Technician shall install conduit for the mass notification system. A Fire Alarm or Audio Technician with a minimum of 4 years of experience shall perform/supervise the installation of the mass notification system. Fire Alarm or Audio Technicians with a minimum of 2 years of experience may be utilized to assist in the installation and terminate mass notification devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the mass notification system. The Fire Alarm or Audio Technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.4 SYSTEM DESIGN

1.4.1 Operation

The mass notification system (MNS) shall be a complete, supervised notification system. The MNS shall essentially duplicate a fire alarm voice evacuation system with supervised speakers, at least 4 prerecorded message capability, and local microphone. The MNS shall be independent of the fire alarm system. No component shall be marked "FIRE." The notification appliance circuit (NAC) shall be capable of operation with a single open and a single ground. A single open, single ground, or wire-to-wire short shall cause a trouble indication at the autonomous control unit. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, NAC will remain functional.

1.4.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of NAC.

b. Monitor electrical supervision of the primary power (ac) supply and battery voltage.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, and removal of alarm zone module (card, PC board).

d. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

e. Electrical supervision for circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

f. Capable of being operated from a remote location

1.4.3 Mass Notification Functions

A mass notification condition shall automatically initiate the following functions:

a. Override all other audible signals in operation (Public Address and Fire Alarm Evacuation) and their volume controls.

b. Audible sounding of mass notification appliances (speakers) throughout the building.

c. Continuous flashing of mass notification strobes throughout the building during announcements.

d. Transmission of a trouble signal to the fire department if a fire alarm evacuation signal is interrupted.

1.4.4 System Performance

The system shall provide even sound distribution throughout the designated area, plus or minus 3 dB for the 1/1 octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newtons per square meter).

1.4.5 Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic.

1.4.6 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 AUTONOMOUS CONTROL UNIT

The Autonomous Control Unit shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control unit shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of supervisory or trouble signals. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted blue.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.2 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the mass notification system shall be provided as part of this contract.

2.2 POWER SUPPLY FOR THE SYSTEM

2.2.1 Primary Power

A single dedicated branch circuit for supplying power to mass notification system autonomous control unit shall be provided. Single dedicated branch circuits for supplying power remote amplifiers and NAC extender units shall be provided. The circuit breakers shall be equipped with a locking mechanisms and marked in red with the words "MASS NOTIFICATION SYSTEM".

2.2.2 Backup Power

2.2.2.1 Storage Batteries

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-acid type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the MNS for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system for a minimum period of 1 hour. Batteries shall be located in a separate battery cabinet. Batteries shall be provided with overcurrent protection. Separate battery cabinets shall have a lockable, hinged cover.

2.2.2.2 Battery Charger

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.3 MICROPHONES

Microphones shall as a minimum conform to the following specifications:

Application:	In-Cabinet Mount Element: Dynamic
Frequency Response:	50 - 12,000 Hz
Impedance:	250 ohms (nominal)
Front-to-back Ratio:	20 dB

2.4 Prerecorded Digital Messages

A Digital Audio Card shall be provided to the store audio source(s) for the MNS. It shall be capable of transmitting 4 digital channels of audio via two pairs of wire. It shall be wired Class A (Style 7) (four pairs of wires). It shall have on-board LEDs for system status and troubleshooting. Indication of power, communication, internal operation, ground fault, and trouble conditions shall be provided. The Card shall contain an on-board microprocessor that provides communication with switch modules, LED modules, and microphone. It shall be capable of supervising up to 99

address. The card shall contain on-board tone generation capability and 4 prerecorded message capacity. In addition custom messages or tones can be downloaded for a total of 5 minutes of storage memory. The card shall be Supervised for open, short and ground fault. Each input/output shall be electrically isolated.

2.5 Input for Future Use

A minimum of 2 auxiliary inputs shall be provided for connection to future twisted pair or wireless equipment.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Surface mounted audible appliances shall be painted to match the surface to which it is mounted. Recessed audible appliances shall be installed with a grille that is painted with a factory finish to match the surface to which it is mounted. All audible notification appliances shall be mounted on back-boxes. Surface mount back-boxes shall be the mass notification system manufacturer's catalog product matched in size, color, and shape to fully support the devices mounted on them. Standard electrical device boxes (sheet metal boxes with knock-outs) shall not be acceptable for surface mount application. Dimensions of back-boxes for surface mount application shall match the dimensions of the initiating devices or notification appliances mounted on them; over-hang shall not be acceptable.

2.6.1 LOUDSPEAKERS

2.6.1.1 Cone Speaker

The cone speaker shall as a minimum conform to the following specifications:

Application:	Ceiling and Wall
Frequency range:	60 to 12,000 Hz
Power Rating:	Normal - 7 watts Peak - 10 watts
Voice Coil Impedance:	8 ohms
Line Matching Transformer Type:	25/70 volt line
Capacity:	2 watts
Magnet:	8 ounces or greater
Primary Taps:	0.25, 0.5, 1, 2, and 4 watts
Primary Impedance:	25 volts - 1250, 625, and 312 ohms 70 volts - 10k, 5k, and 2.5k ohms

Insertion Loss: Less than 1 dB

2.6.1.2 Horn Speaker

The horn speaker shall as a minimum conform to the following specifications:

Application:	Weatherproof
Frequency Response:	250 - 14,000 Hz
Power Taps:	70 volt line - .65, 1.25, 2.5, 5.0, and 7.5 watts
Power Rating:	7.5 Watts continuous
Dispersion:	120 degrees
Sound Pressure Level:	105 dB @ 1.2 meter on axis with 7.5 Watt input @ 1000 Hz

2.6.2 VISUAL NOTIFICATION APPLIANCES (STROBES)

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output amber light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum candela rating as required per NFPA 72. Strobe shall be semi-flush mounted or mounted as a combination unit with speaker.

2.6.2.1 COMBINATION AUDIBLE/VISUAL NOTIFICATION APPLIANCES

Notification appliances shall be combination audible/visual notification appliances and shall meet the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the MNS shall be approved by the Contracting Officer.

2.7 INTERFACES

2.7.1 Fire Alarm

The mass notification system shall take priority over fire alarm evacuation signals during MNS announcements. The fire alarm system shall transmit a trouble or supervisory signal to the fire department when this occurs. MNS circuit trouble and supervisory signals shall be sent to the fire department via the fire alarm transmitter.

2.7.2 Public Address

The mass notification system shall take priority over public address functions and shall interrupt PA programming during MNS announcements.

2.8 PERIPHERAL EQUIPMENT

2.8.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.8.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. All wiring shall comply with the requirments of NFPA 70 and NFPA 72 for a Class A wired, fully addressable system. Conductors shall be color coded. Color for mass notification shall be different than those used for telephone, data, EMCS or other low voltage system. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to notification appliance circuits are prohibited.

2.8.3 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

3.1.1 Autonomous Control Unit

The control unit and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 305mm nor more than 1981mm above the finished floor. Manually operable controls shall be between 914mm and 1219mm above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the mass notification system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and

conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The mass notification equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Speakers

Speakers mounted in suspended ceilings shall be mounted on load bearing steel supports (T-bar bridge). All speakers shall have back-boxes or surface mount boxes with grilles.

3.2 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.3 TESTING

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 14 days prior to the performance of tests. In no case shall notice be given before the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall demonstrate intelligibility greater than 0.70 on the Common Intelligibility Scale (CIS) or greater than 0.50 on the Speech Transmission Index (STI) in accordance with the International Electrotechnical Commission (IEC) Standard 60849.

3.4 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for shall consist of 2 hours and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the mass notification system.

-- End of Section --

SECTION 16777

AUDIO SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

1.2 DESCRIPTION OF WORK

1.2.1 Extent of Work:

Work under this contract shall include the furnishing of materials, labor, tools, transportation services, etc., necessary to complete the installation of the Audio System as described in these specifications and illustrated in the accompanying drawings.

1.2.2 Professional Support:

The contractor shall retain the services of a qualified structural Engineer to design the details of any and all structural mounting, loudspeaker supports and rigging details.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

Detail drawings shall consist of illustrations, schedules, performance charts, instructions, brochures, diagrams, catalog cuts, manufacturer's data, materials and equipment lists, and operational and general maintenance instructions. Detail drawings shall be submitted for the overall system and for each major component. Drawings shall illustrate how each item of equipment has been coordinated and will function properly in the system. Detail drawings shall include an overall system schematic indicating relationship of intercommunication units on a one-line diagram and showing power source, system controls, impedance matches, plus number,

size, and maximum lengths of interconnecting wires and indicate clearances required for maintenance and operation. Calculations for power requirements of equipment shall be provided.

Additionally, the submittal shall include the following items under separate tabs:

a. Complete schedule of all equipment and materials to be used.

b. Shop drawings indicating exact dimensions, details, and configuration for:

1. Point-to-Point wiring diagram showing detailed, numbered wiring between all devices, connections, plates, etc.

2. Central Cluster Diagram

3. Rigging diagrams for all loudspeakers showing hardware selection and sizing and including stamped drawings by a registered professional structural engineer.

4. Any cabinets, tables, or enclosures applicable to the audio systems.

c. Label artwork indicating designations and details

1. Sample of cable marking methods

2. Sample of intended equipment labeling

3. Sample of plate engraving details.

SD-03 Product Data

Spare Parts

Spare parts data for each different item of material and equipment specified.

Manufacturer's Catalog;

Data composed of catalog cuts, brochures, circulars, specifications, product data (including frequency response curves), and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists;

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures;

Installation procedures for audio components. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

SD-06 Test Reports

Field Test Plan; G.

A detailed description of the Contractor's proposed procedures for onsite test submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits. The test plan shall include the following:

System Installation Testing:

The procedure for system installation testing shall include, but not be limited to, the following:

a. Verify functional and operational performance of all equipment and wiring.

b. Test polarity of all equipment and wiring.

c. Test continuity of all outlets, inputs and outputs, for shorts, open connections, or poor connections.

d. Check all loudspeakers for rattles, buzzing, and/or functional problems using a sweep test signal as follows:

1. Sweeps should not exceed the manufacturers rated bandwidth

2. Sweep signal should be amplified to one-quarter the rated power handling capacity of the loudspeaker under test.

e. Check for oscillation or radio frequency interference with an oscilloscope at the output of the power amplifiers.

1. Check systems operating at idle operations.

2. Check systems operating with a 100 hertz sine wave driving the system at one-quarter maximum rated power capacity of the loudspeaker operating at that frequency.

System Performance Testing:

The procedure for system installation testing shall include, but not be limited to, the following:

a. Measure and record the impedance of each loudspeaker line at 50 hertz, 500 hertz, and 5000 hertz with the loudspeakers installed and configured as called for in the design documents.Verify functional and

operational performance of all equipment and wiring.

b. Measure and record the overall system hum and noise levels at a typical location within the room with the following settings described below. Acceptable system hum and noise levels shall be those which are not determined as objectionable by 80% of the people present during testing. If this is not met, the contractor shall reconfigure the system to ensure system hum and noise is minimized. Test polarity of all equipment and wiring.

1. A typical microphone input terminated at 200 ohms.

2. The console gain set so that a -30 dBm input signal produces a console output of 0 dBm.

3. All signal processing equipment set to unify gain and flat equalization, and

4. Power amplifier set to provide maximum gain.

Field Test Reports; G

Six copies of the information described below in 216 x 280 mm binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The conditions specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

h. Final position of controls and device settings.

SD-07 Certificates

Components

Copies of current approvals or listings issued by UL, or other nationally recognized testing laboratory for all components.

SD-10 Operation and Maintenance Data

Audio System

Submit in accordance with Section 01701 OPERATIONS AND MAINTENANCE MANUALS

1.4 PRODUCT CONTINUITY

1.4.1 Product Types:

If multiple acceptable products are listed, provide the same equipment for each type of product. Contractor shall provide products that will provide a complete and usable system. Equipment from the same manufacturer shall be used as recommended or required to ensure a complete and usable system.

1.5 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer, and as shown.

1.6 SYSTEM DESIGN

The Audio system in the Worship Center and Activity Center shall provide intelligible acoustical sound to each area according to the functional criteria described below. The sound system shall have the capability of providing sound to the Worship Center and Activity Center independently from one another, thus allowing each space to be used for a different function at the same time.

There are two operable partitions that separate the Worship Center from the Activity Center. The space created by these partitions is the Expansion Area. The sound system of the Expansion Area shall be configurable to work with either the Activity Center or Worship Center or turned off if the space is not being used.

The complete sound system (combined Worship Center, Expansion Area, and Activity Center) shall have the capability of providing the comprehensive delivery of sound to the expanded Worship Center when both operable partitions are opened. When the sliding partitions are both opened, sound transmitted from the Worship Center Stage shall be intelligible per industry standards at the back of the room, near the Activity Center Stage. If required, time delays shall be added to the distribution of sound in this scenario.

Additionally, the Audio system of the Worship Center shall be connected to an auxiliary input of the Radio and Public Address system described in Specification 16770, to allow users throughout the Chapel to listen to activities going on in the Worship Center. When activities are taking place in both the Worship Center and Activity Center, the system shall be limited to broadcast information from the Worship Center across the Public Address system to rooms indicated on the drawings.

1.6.1 Worship Center Audio System

Uses of the Worship Center may include, but not be limited to: worship services, including contemporary band and traditional choir services. The transmission of music shall be a focus of the sound system in the Worship

Center.

The Worship Center sound system shall have the following capabilities:

a. SPL for spoken word: 75 to 85 dB

b. SPL for music: 95 to 105 dB

c. Frequency response of speakers: 50 to 18,000 Hz

d. Minimum Mixer Console Inputs: Podium mic (2), wireless mic (4), choir mic (8), piano, lectern/reader mic, baptistery mic with on/off switch (2), vocals (5), guitar/instruments (3), drums, keyboard, other (3), CD, cassette deck, video/projector system: TOTAL = 34.

The Worship Center sound system shall be controlled from Control Booth 112. The Control Booth shall have a minimum of two wall outlet connections for future monitors (not included in contract) to be installed in the Control Booth. Outlets shall be located as shown on the plans.

The Worship Center shall have two microphone wall outlet connections for a speaker to be used in coordination with the Baptistery. Microphone connections shall be located as shown on plans. Baptistery microphone shall have on-off wall switch located nearby.

1.6.2 Expansion Area Audio System

The Expansion Area is intended to be used for large worship services taking place in either the Worship Center or Activity Center. There are two operable partitions that separate the Expansion Area from the Worship Center and Activity Center. Ceiling speakers shall be provided in Expansion Area to augment sound from either the Worship Center or Activity Center. The sound system in the Expansion Area shall be configurable to be used by the Worship Center, Activity Center, or be turned off.

1.6.3 Activity Center Audio System

Uses of the Activity Center may include, but not be limited to: smaller worship services, teaching and presentations, and as an assembly area for receptions. The transmission of the spoken word shall be a focus of the sound system in the Activity Center.

The Activity Center sound system shall have the following capabilities:

a. SPL for spoken word: 75 to 85 dB

b. SPL for music: 95 to 105 dB

c. Frequency response of speakers: 50 to 18,000 Hz

d. Minimum Mixer Console Inputs: Podium mic, wireless mic (4), piano, vocals (5), guitar/instruments (3), drums, keyboard, other (3), CD, cassette deck, video/projector system: TOTAL = 22.

The Activity Center sound system shall be controlled from Control Booth 112.

Additionally, a wall outlet shall be provided on the South Wall of the Activity Center at the location shown on the drawings to allow future connection of a portable professional audio mixing board comparable to the mixing board installed in the Control Booth. The mixing board in the Activity Center may be installed in the future; the intent of the wall outlet is to provide all required cabling and connections to allow future sound control from this location for the Activity Center Sound System.

1.7 Qualifications

1.7.1 Installer

Installation shall be performed only by experienced sound system installers with a minimum of 3 years experience on similar size and scope projects. Each installer shall have access to a complete copy of the audio system plates, specifications, and approved shop drawings at the job site.

All equipment and materials shall be installed in accordance with NFPA 70 and any other applicable codes including local municipality codes, safety codes, and ordinances.

The Contractor shall coordinate all work with other trades to avoid causing delays in construction schedule.

PART 2 PRODUCTS

Products listed below are used to set the minimum acceptable standard. Other products may be used if proved equal to those below.

2.1 EQUIPMENT RACKS (RCK)

2.1.1 Type 2 - 40 RU Standard Rack:

a. Type: free standing, standard NEMA equipment rack.

b. Vertical racking space: 1778mm (40 units)

c. Minimum depth: 635mm

d. Doors: Solid, removable front & vented rear doors

e. Mounting Rails: Front & rear sets with standard EIA, threaded mounting holes.

f. Quantity: As required per contractor's design, minimum of 1.

g. Acceptable manufacturers include, but not limited to:

1. Atlas Soundolier

2. Lowell

3. Middle Atlantic

2.1.2 Type 3 - 35 RU Standard Rack:

a. Type: free standing, standard NEMA equipment rack

b. Vertical racking space: 1555mm (35 units)

c. Minimum depth: 635mm

d. Doors: Solid, removable front & vented rear door.

e. Mounting Rails: Front & rear sets with standard EIA threaded mounting holes.

f. Quantity: As required per contractor's design, minimum of 1.

g. Acceptable manufacturers include, but not limited to:

1. Atlas Soundolier

2. Lowell

3. Middle Atlantic

2.2 PANEL MOUNTED AUDIO CONNECTORS

2.2.1 Panel Mounted Audio Connectors

a. Description: Connectors for audio system.

b. Type & Conductor Count: As required per contractor's design.

c. Wire Connection: Solder connections.

d. Color: As determined by Contracting Officer

e. Acceptable manufacturers include, but not limited to:

1. Canare.

2. Neutrik.

3. Switchcraft.

2.3 SPECIAL MICROPHONES (MIC)

2.3 Fixed Hanging Microphone:

a. Function:
Hanging microphone for Choir Area

b. Element:

Cardioid Instrument Microphone Condenser, ultra thin diaphragm transformerless preamplifier circuitry pattern, 20Hz- 20kHz

c. Provide Mic Slugs for Hanging

d. Color: As determined by Contracting Officer

e. Quantity: As required per contractor's design. Contractor shall install minimum of 8 fixed hanging microphones.

f. Acceptable manufacturers include, but not limited to:

1. Shure

2. Sennheiser

3. AKG

2.4 WIRELESS MICROPHONE SYSTEM (WMR)

Wireless microphone system is not included in contract. Contractor shall provide rack space for minimum of four (4) pieces of rack mounted equipment, to be installed in the future.

2.5 ASSISTIVE LISTENING SYSTEM (ALR)

Assistive listening device is not included in contract. Contractor shall provide rack space for minimum of four (4) pieces of rack mounted equipment, to be installed in the future.

2.6 FLOOR POCKET (FP)

2.6.1 General Large Floor Pockets on Worship and Activity Center Platforms:

a. Description: Large, fully adjustable, floor pocket with removable connector plate and a cableway slot.

b. Minimum capacity: four (4) XLR connectors, one (1) duplex receptacle, and two (2) RJ-45 communications outlets.

c. Lid: Flushmount

d. Finish: To match wood platform.

e. Back Box: Provide manufacturer's standard back box.

2.6.2 Floor Boxes in Worship and Activity Center Concrete Floor:

a. Description: Small, fully adjustable, floor pocket with removable connector plate and a cableway slot.

b. Minimum capacity: one (1) duplex receptacle, OR two (2) RJ-45 communications outlets, as shown on plans.

c. Lid: Flushmount

d. Finish: To match concrete floor, or as acceptable to Contracting Officer.

e. Back Box: Provide manufacturer's standard back box.

2.7 AUDIO MIXERS (MIX)

2.7.1 Soundcraft Series TWO, 24 Channel audio mixer or approved equal.

L>

a. Function: Mixer for both Worship Center and Activity Center sound system. 24 Channel, 8 true busses, 8 auxiliary, 8 group outputs, 8 mute groups.

b. Quantity: As required per contractor's design, minimum of 1.

2.8 RACK MIXERS (RMX)

2.8.1 16 channel balanced mic/line inputs Mixer:

a. Function: 3 band mid sweep Equalizer, 4 Stereo returns, separate mono sum output, Rack mount

b. Quantity: As required per contractor's design, minimum of 4.

c. Acceptable manufacturers include, but not limited to:

1. Soundcraft

2. Allen & Heath

3. Midas

2.9 AUDIO SIGNAL PROCESSORS (ASP)

2.9.1 Alesis Multi-effects Processor:

a. Function: Alesis multi-effects processor

b. Quantity: As required per contractor's design, minimum of 1.

c. Acceptable manufacturers include, but not limited to:

1. Alesis

2. Lexicon

2.10 DIGITAL SIGNAL PROCESSORS (DSP):

2.10.1 BSS BLU-80 DSP or approved equal.

a. Function: 32x32 32 channel audio processing; 8 input 8 output base

configuration

b. Quantity: As required per contractor's design, minimum of 1.

2.11 POWER AMPLIFIERS (PA)

2.11.1 Worship Center 70 Volt Power Amplifier: CROWN CH-4 or approved equal

a. Power output: 70 volts 1200 watts, biamp

b. Quantity: As required per contractor's design, minimum of 3.

2.11.2 Activity Center Low Power Amplifier: CROWN CTS-8200 or approved equal.

a. Power output: 200 watts 4 ohms stereo, biamp

b. Quantity: As required per contractor's design, minimum of 4.

2.11.3 Worship Center 70V & 100V Power Amplifier: CROWN CH-2 or approved equal.

a. Power output: 600 watts 4 ohms stereo,biamp

b. Quantity: As required per contractor's design, minimum of 3.

2.12 GENERAL LOUDSPEAKERS (SP)

2.12.1 Worship Center Center Cluster Speakers: JBL AM6215 or approved equal.

a. Function: two-way biamp full-range 90 x 50 (Mains)127/133 db

b. Quantity: As required per contractor's design, minimum of 3.

2.12.2 Worship Center Floor Monitor: JBL JRX112M or approved equal.

a. Function: 300mm two-way portable passive monitor

b. Quantity: 2.

2.13 CEILING LOUDSPEAKERS (CSP)

2.13.1 Activity Center/Expansion Area ceiling speakers: JBL 26CT or approved equal.>

a. Driver: nominal 4 inch cone driver

b. Power Handling Capacity: Minimum 30 watts

c. Transformer: 70.7 volt, maximum 25 watt multi-tap line transformer

d. Baffle: Unless otherwise shown, round, painted steel baffle with concealed speaker mounting studs.

e. Back Enclosure: Manufacturer's recommended unit with conduit punchouts

f. Quantity: As required per contractor's design. Locations shown on drawings are for reference only.

2.14 LOUDSPEAKER HARDWARE & ACCESSORIES

2.14.1 General rigging hardware

a. Function: general rigging hardware

b. Description: drop forged or machined metal parts with a safety design factor of five or greater.

c. Finish: galvanized or rust-resistant painted

d. Size: proper size for connections and wiring system and for adequate safety factor

2.14.2 Wire Rope:

a
. Function: wire rope

b. Description: galvanized, multi-stranded rope

c. Size/Safety: size as required; with a safety factor of at least six(6).

2.15 AUDIO CONTROL RELAY (ACR)

2.15.1 Type 2 - Speaker A/B:

a. Function: speaker A/B

b. Acceptable manufacturers include, but not limited to:

1. FSR

2.16 AUDIO INTERFACES

2.16.1 Type 1 - Audio Direct Box:

a. Function: audio direct box

b. Description: designed to accept an unbalanced line or instrument level source and provide a balanced output; constructed using the manufacturer's transformer and wired per their recommendation; with a switch to interrupt the ground to pin one.

c. Acceptable manufacturers include, but not limited to:

1. Pro-Co or equal

2.17 AUDIO CORDS

2.17.1 Type 1 - Portable Microphone Cord:

a. Connectors: male & female black shell 3-pin XLR type connectors

b. Wire: low impedance rubber jacketed, braided shield wire

c. Acceptable manufacturer is:

1. Pro-Co or equal

2.17.2 Type 5 - Speakon Monitor Speaker Cords:

a. Cord: neoprene jacketed, 12 gauge 2-conductor wire

b. Connectors: Neutrik Speakon NL4FC connector, both ends

c. Acceptable manufacturers include, but not limited to:

1. Pro-Co or equal

2.18 AUDIO CABLES

2.18.1 Type MC - Precision Microphone Level Cable:

a. Function: precision microphone level cable

b. Conductor Number: One pair

c. Conductor Size: 12 AWG Stranded.

d. Shield: 100% foil with 12 Awg drain wire

e. Jacket type: PVC

f. Acceptable manufacturers include, but not limited to:

1. Belden

2. West Penn

2.18.2 Type LC - Line level Cable:

a. Function: line level cable

b. Conductor Number: One pair

c. Conductor Size: 12 AWG stranded

d. Shield: 100% foil with 12 Awg drain wire

e. Jacket type: PVC

f. Jacket color: Non-gray

g. Acceptable manufacturers include, but not limited to:

1. Belden

2. West Penn

2.18.3 Type EBU - AES/EBU Line Level Cable

a. Function: AES/EBU line level cable

b. Conductor Number: One pair

c. Conductor Size: 12 AWG Standard

d. Shield: 100% foil with 12 AWG drain wire

e. Jacket type: PVC

f. Jacket color: Gray

g. Acceptable manufacturers include, but not limited to:

1. West Penn

2. Belden

2.18.4 Type S10 (Alternate) Main Speaker Level Cable

a. Function: Main speaker level cable

b. Description: 12 gauge THHN stranded conductor

c. Jacket colors: black and white

2.18.5 Type S12 - Monitor Speaker Level Cable:

a. Function: Main speaker level cable

b. Description: single twisted pair of 12 gauge speaker level wiring with one each black and white conductors paired.

c. Jacket color: white

d. Acceptable manufacturers include, but not limited to:

1. Belden

2. West Penn

2.18.6 Type S12 (Alternate) - Main Speaker Level Cable:

a. Function: main speaker level cable

b. Description: 12 gauge THHN stranded conductor

c. Jacket color: black and white

2.18.7 Type S14 - Monitor speaker Level Cable:

a. Function: monitor speaker level cable

b. Description: vinyl jacketed, two conductor 12 gauge type.

2.18.8 Type S16 - Distributive Speaker Level Cable

a. Function: distributive speaker level cable

b. Description: vinyl jacketed, two conductor 16 gauge type.

2.19 MISCELLANEOUS CABLES

2.19.1 Type RG6 - Antennae Wiring - 75 Ohm Coaxial Cable:

a. Function: antennae wiring - coaxial cable

b. Description: 75 ohm low-loss RG-6/U coax with 12 gauge solid center conductor and braided copper shield

2.19.2 Type RG8 - Antennae wiring - 50 Ohm Coaxial Cable

a. Function: antennae wiring - coaxial cable

b. Description: 50 ohm, low-loss, RG-8/U coax with 12 gauge stranded center conductor and braided copper shield

2.20 CONNECTORS

2.20.1 Cable Mounted Audio Connectors:

a. Function: cable mounted audio connectors

b. Type/number: as required to match respective jack

c. Features: solder connections and a shielded handle

d. Color: silver

2.21 TERMINAL BLOCKS

2.21.1 Type 1 - Line Level Terminal Block

a. Function: line level terminal block

b. Description: standard, double row barrier type using a #5/32 screw spaced at least 9.5mm apart.

c. Provide in even intervals of three (3).

2.21.2 Type 2 - Speaker Level Terminal Block:

a. Function: speaker level terminal block

b. Description: standard, double row barrier type using a #8/32 screw panel spaced at least 13mm apart.

c. Provide in even intervals of two (2).

2.22 POWER CONDITION DEVICE (PCD)

2.22.1 Power Condition Device:

a. Acceptable manufacturers include, but not limited to:

1. ETA

2. Furman

3. SurgeX

2.23 POWER OUTLET STRIPS (STP)

2.23.1 Power Outlet Strips

a. Labels: per UL #514A, NEMA OS-1, and NFPA 70.

b. Acceptable manufacturers include, but not limited to:

1. Furman

2. Middle Atlantic

3. Wiremold

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General:

All equipment and enclosures described in this specification shall be installed plumb and square. All equipment shall be installed permanently attached to structure. Supports shall be adequate to support their loads with a minimum safety factor of five. All work shall be in accordance with NFPA 70, and in accordance with the manufacturer's diagrams and recommendations.

3.2 AC POWER DISTRIBUTION

3.2.1 General:

Design, provide, and install AC power distribution system for all audio systems as follows:

a. The power distribution system shall plug into power receptacles as provided in building.

b. The power distribution system shall be bonded to the isolated ground from the A/V panel board and electrically isolated from all other grounds. Power system outlets and devices located within A/V enclosures or at control positions shall not be isolated grounds.

3.2.2 Power Distribution:

Provide distribution strips and outlets as follows:

a. In all equipment enclosures, provide full height, vertical outlet strip with branch circuits on the left side of enclosures as viewed from the rear.

b. For equipment not mounted in enclosures and requiring sequential power, either derive power from a power strip in a nearby enclosure or provide a local switched power outlet. Conceal power outlet as much as possible.

3.2.3 Power Conditioning

a. Provide conditioned power for the following:

1. All DSP devices.

3.2.4 Power Sequencing

a. Sequence: In addition to constant powered (non-switched) condition, the power distribution system shall have at least two (2) steps of sequential power turn on/off as follows:

1. During Power turn-on, the General Power circuits shall turn on before the Amplifier Power Circuits.

2. During Power turn-off, the Amplifier Power circuits shall turn off before the General Power Circuits.

3. The delay between the General Power circuits and the Amplifier Power circuits shall be at least 5 seconds.

b. General Power: The following devices and systems shall be switched as part of the General Power sequence:

1. All audio system devices except those listed in Amplifier power.

c. Amplifier Power: The following devices and systems shall be switched as part of the Amplifier Power sequence:

1. All power amplifiers.

d. Sequencing device: Provide as follows:

1. If project has a digital control system, utilize control system to generate sequencing control signals.

2. Otherwise, provide a dedicated sequencer and locate in amplifier racks.

e. Power Control: Provide power control as follows:

1. Power on/off switch(s) shall be provided in the Control Booth and shall control all power circuits.

2. An emergency shut-off connection shall be provided for alarm system control of power. Audio system shall shut down when fire alarm is activated.

3.3 EQUIPMENT RACKS

All racks shall be assembled as indicated and as follows:

a. All racks shall be pre-wired as much as possible.

b. All electronic equipment, except those shown otherwise, rack fans, and vent panels shall be housed in the equipment racks Using black 10-32 Phillips or Allen head screws with black fiber washers.

c. Unless otherwise indicated, all patch bays should be recessed in racks to accommodate closing the front door with patch cables inserted in patch bays.

d. All unused spaces shall be filled with solid blank panels. Blank panels shall be mounted using same screws and washers as equipment in the rack.

3.3.1 Rack Wiring Management & Containment:

All wiring connection to racks shall be connected as follows:

a. All fixed position racks shall be connected to junction boxes or back boards by non-conductive flexible conduit.

b. All fixed position racks shall be connected to cable trays by rigid conduit with an isolation connector at the rack.

c. All racks that have movable for installation but otherwise fixed position shall be connected to junction boxes or back boards by non-conductive flexible conduit.

d. For all mobile or movable equipment, an umbilical of sufficient cable length shall be provided to move equipment either for access or relocation.

1. Multiple umbilical cables shall be provided as to provide cable separation as required in this and other section.

2. Umbilical cables shall be bundled with a non-adhesive wrapping.

3.4 GROUNDING

All grounding practices shall comply with NFPA 70. Equipment shall be grounded to the serving panelboard ground bus through a green grounding conductor. Metallic conduits serving the equipment shall be isolated on the equipment end with an insulating bushing to prevent noise from being transferred to the circuit. Equipment racks shall be grounded to the panelboard ground bus utilizing a #8 conductor. Grounding conductor shall be terminated to the rack using connector suitable for that purpose.

3.4.1 Interference

All necessary precautions shall be taken to minimize electromagnetic and electronic interference in the completed audio system.

3.5 WIRING PRACTICES

3.5.1 Cable Type:

Any cable not encased in conduit and located in a return air plenum or any cable required by code shall be plenum rated.

a. Plenum rated cable shall meet all performance criteria as specified non-plenum cable.

3.5.2 General:

All wiring shall be executed in accordance with accepted "broadcast standards" and as follows:

a. All audio equipment input and output wiring shall be configured as balanced, low impedance, and floating lines.

b. Circuits shall not be spliced except as approved.

c. Proper polarity shall be observed when wiring loudspeakers. The specified wiring color code for loudspeaker wiring shall be observed to maintain uniformity throughout the project.

d. Only one cable or set of wires should be installed into any single connector; cable shall not be looped in and out of a connector. Terminal block shall be provided to parallel connect audio signal wiring.

e. All wiring and conduit run through the Worship, Expansion, and Activity Centers shall be run under the slab. No exposed conduit is allowed in the Worship center or Activity Centers. Any conduit run across the ceiling of the Worship Center and Activity Center shall be run in an inconspicuous manner, so it is not visible from the seating

areas. Such conduit and wiring shall be painted to match the surface along which it travels to the satisfaction of the Contracting Officer.

Wiring Labels: At all connection points for all types of cable & wiring, a label strip shall be attached indicating the name/number of that cable or wire as follows:

a. At internal locations (inside racks, cabinets, or boxes), a pressure sensitive label shall be used.

b. At external locations, a printed label covered with clear shrink rap or approved labeling system shall be used.

Equipment Labels: All active components shall have engraved lamicoid labels at the front and rear.

a. Labels shall be mounted plumb and neat and shall not cover any equipment lights, recessed controls, or control labels.

b. Front labels shall indicate functional use of equipment.

c. Rear labels shall indicate system schematic reference designation.

3.5.3 Wiring Standards:

All wiring shall be consistent and shall comply with the following:

a. All audio circuits shall be wired with white or red as high signal and black as low signal.

b. As per IEC-60268, all XLR type connectors shall be wired with Pin 1 as shield, Pin 2 as high signal, and Pin 3 as low signal.

c. All patchboy connections and associated cables shall be wired with sleeve as shield, tip as high signal, and ring as low signal.

3.5.4 Wiring Segregation:

All wiring in racks and within conduit systems shall be segregated according to signal level and/or function as follows:

a. Microphone level circuits (lower than -20 dBm)

b. Line level circuits (-20 to 30 dBm and DC control circuit)

c. Speaker level circuits (greater than 30 dBm)

d. AC power circuits

3.5.5 Termination Resistors:

Termination resistors shall be provided required per Contractor's design. Resistors shall be installed at end of the line at the input to the equipment as to limit length of high impedance circuit runs.

Resistors must be mounted visible and external to the devices being terminated and not within connectors.

3.5.6 Shielding:

Shield/drain wires on all audio circuits shall not be connected to any other points, including conduit. This wire shall be exposed at all connection points and included with green sleeving or tubing.

Shield/drain wires shall not be connected to the body at any time.

3.5.7 Connections:

All connections shall be made in compliance with industry standards, according to manufacturer of connector, and as follows:

a. Spade lugs used for speaker level lines shall be insulted type. All other spade lugs shall be un-insulated.

3.5.8 Connector Options:

If option of multiple connector types is available on a given piece of equipment, the preferences are as follows:

a. Euro-style connectors with tinned cable ends.

b. Terminal blocks and spade lugs.

c. XLR type connector.

d. Phone plug connector.

3.6 LOUDSPEAKER INSTALLATION

3.6.1 General:

Loudspeakers shall be mounted to or suspended from the glu-lam structure as shown in the drawings. Mounting or suspension system shall be designed by the contractor and approved by the government.

a. Any openings required for loudspeakers shall be cut and finished.

3.6.2 Main or Cluster Loudspeakers:

Main loudspeakers shall be mounted individually or in clusters as shown on the drawings and as follows:

a. Loudspeakers shall be mounted in such a manner as to allow adjustment of location and angle and tilt of individual cabinets or devices.

b. Contractor shall test and adjust loudspeakers as required per approved Testing Procedures.

1. Contractor shall maintain all access to the loudspeakers, including but not limited to scaffolding and mechanical lifts.

2. Contractor shall provide technicians to adjust the loudspeakers as directed by test results.

3. Contractor shall provide the capacity to energize all loudspeakers in all of the cluster by either permanent or temporary power amplifiers and crossovers during testing.

3.6.3 Ceiling Mounted Loudspeakers:

All ceiling mounted loudspeaker shall be mounted flush in their respective surface as follows:

a. Backboxes, baffles, and tile bridges shall be provided for all ceiling loudspeakers located in suspended ceilings.

b. Baffles shall be provided for all ceiling loudspeakers located in non-accessible ceiling areas and where back boxes have been provided with conduit system.

3.7 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests in accordance with paragraph FIELD TEST PLAN for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.8 ADJUSTMENTS AND SETUP

3.8.1 Audio Test Equipment:

The Contractor shall provide the following professional test and measuring equipment for use during testing:

a. Third Octave Realtime Analyzer:

Autio Control Industries SA-3-5-A or equal.

b. Pink Noise Generator:

Either self-contained unit or CD player with acceptable test signal disk. Signal generator contained within the realtime analyzer is not acceptable.

c. Time-Energy Analyzer:

Techron TEF10 or equal with Bruel & Kjaer Microphone or equal and cables of sufficient length to cover entire room.

-- End of Section --

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SECTION 16792

WIRE LINE DATA TRANSMISSION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-84-608	(2002) Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

1.2 SYSTEM DESCRIPTION

1.2.1 General

A half or full duplex wire line data transmission system (DTS) for communication between a local device and a central processor shall be provided. The local device is used to process locally generated information and communicates that information to the central processor. The central processor is a computer-based system that takes the information received from the local processor and processes that information. The DTS shall consist of MODEMS (headend and remote) or line drivers, or both, connected to the local device and the central processor. The MODEMS are connected by transmission lines and terminal devices such as connectors and terminal strips. Communication links surge protection and powerline surge

protection shall be provided at both ends of the transmission line. All computing devices, as defined in 47 CFR 15, shall be certified to comply with the requirements for Class B computing devices and labeled as set forth in 47 CFR 15.

1.2.2 Environmental Requirements

1.2.2.1 Indoor and Outdoor Environments

Equipment and cable to be used indoors shall be rated for continuous operation under ambient environmental conditions of 0 to 50 degrees C dry bulb and 10 to 95 percent relative humidity, noncondensing. Equipment and cable to be used outdoors shall be rated for continuous operation under ambient environmental conditions of minus 40 to plus 70 degrees C and humidity of up to 100 percent condensing or as normally encountered for the installed location. All equipment shall be rated for continuous operation under the ambient vibration conditions encountered for the installed location. Components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust or ignitable fibers or flyings, shall be rated and installed in accordance with Chapter 5 of NFPA 70.

1.2.3 Electrical Requirements

The equipment shall operate from 120/208 VAC, plus or minus 10 percent.

1.2.4 Power Line Surge Protection

All equipment connected to AC circuits shall be protected from power line surges. Equipment shall withstand surge test waveforms described in IEEE C62.41. Surge protection devices shall be selected based on voltages and current ratings of components to be protected. Fuses shall not be used for surge protection.

1.2.5 Communications Circuit Surge Protection

All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors which serve as communications circuit between the local processor and the central processor shall have surge protection devices installed at each end. Protection shall be provided at the equipment and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 1 m of the building cable entrance. Surge protection devices shall be selected based on voltages and current ratings of components to be protected. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

a. A waveform with a 10 microsecond rise time, a 1000 microsecond width, a peak voltage of 1500 volts and a peak current of 60 amperes.

b. A waveform with an 8 microsecond rise time, a 20 microsecond waveform, a peak voltage of 1000 volts and a peak current of 500 amperes.

1.3 DELIVERY OF TECHNICAL DATA

All items of technical data which are specifically identified in this specification will be delivered strictly in accordance with the CONTRACT CLAUSES, SPECIAL CONTRACT REQUIREMENTS, Section 01330 SUBMITTAL PROCEDURES and the Contract Data Requirements List, DD Form 1423, which is attached to and made a part of this contract. Technical data submitted shall be coordinated with the requirements of Section 16751 CLOSED CIRCUIT TELEVISION SYSTEMS. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished 4 hard copies and 4 electronic copies (CD-ROM or DVD-R) of the Technical Data Package(s) shall be submitted.

1.3.1 Group I Technical Data Package

1.3.1.1 System Drawings

The data package shall include the following:

a. Data Transmission system block diagram.

b. MODEMS or line drivers or both, installation, block diagrams, and wiring diagrams.

c. MODEMS or line drivers or both, physical layout and schematics.

d. Details of connections to power sources, including grounding.

e. Details of interconnection with served system components.

f. Details of surge protection device installation.

g. Details of cable splicing and connector installation.

h. Details of underground, aerial, and messenger cable installation on poles, cable entrance to building.

1.3.1.2 Manufacturers' Data

The data package shall include manufacturers' data for all materials including field and system equipment provided under this specification.

1.3.1.3 DTS Description and Analyses

The data package shall include complete system descriptions, analyses, and calculations used in selecting equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance of this specification. The data package shall include the following:

a. MODEM or line driver receive and transmit levels, signal-to-noise ratio calculations and assumed losses in decibels (dB) on each communication circuit. Contractor shall use manufacturer's minimum and

maximum signal-to-noise ratio (db) of the actual equipment being furnished for the DTS.

b. Communication speed and protocol description.

c. Data transmission system expansion capability and method of implementation.

1.3.1.4 Certifications

All specified manufacturer's certifications shall be included with the data package.

1.3.2 Group II Technical Data Package

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall submit a report to the Government documenting changes to the site, or conditions that affect performance of the system to be installed. For those changes or conditions which affect system installation or performance, provide (with the report) specification sheets, or written functional requirements to support the findings, and a cost estimate to correct the situation. The Contractor shall not perform any corrections without written permission from the Government.

1.3.3 Group V Technical Data Package

1.3.3.1 Manuals

Final copies of the manuals bound in hardback, loose-leaf binders, shall be delivered to the Government within 30 days after completing the endurance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representative for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Manuals delivered shall include:

a. Functional Design Manual: 2 copies 2 CD-ROM or DVR-R.

b. Hardware Manual: 2 copies 2 CD-ROM or DVR-R.

c. Maintenance Manual: 2 copies 2 CD-ROM or DVR-R.

d. Operator's Manual: 6 copies 3 CD-ROM or DVR-R.

1.3.3.2 Functional Design Manual

The functional design manual shall identify the operational requirements for the data transmission system and explain the theory of operation,

design philosophy, and specific functions. A description of hardware functions, interfaces, and requirements shall be included for all system operating modes.

1.3.3.3 Hardware Manual

A manual describing all equipment furnished, including:

a. General description and specifications

b. Installation and checkout procedures.

c. Equipment electrical schematics and layout drawings.

d. Data transmission system schematics.

f. Manufacturer's repair parts list indicating sources of supply.

g. Interface definition.

1.3.3.4 Operator's Manual

The operator's manual shall fully explain all procedures and instructions for operation of the system.

1.3.3.5 Maintenance Manual

The maintenance manual shall include descriptions of maintenance for all equipment including inspection, provide preventive maintenance, fault diagnosis, and repair or replacement of defective components. Software description, use of all diagnostic tools, loading software on the system and to the memory shall be included.

1.3.4 Group VI Technical Data Package

The Group VI Technical Data Package shall consist of the as-built drawings revised to include system revisions and modifications. Copies of the updated as-built drawings shall be delivered to the Government following approval of the PVT and endurance test.

PART 2 PRODUCTS

2.1 COMMUNICATIONS EQUIPMENT

Communications equipment for circuits between sensors and field processors, and between the field processors and central processor, shall be capable of transmitting data within the error rate specified over the distances shown. For wireline equipment, the maximum permissible error rate shall be 1 in 100,000.

2.1.1 Line Drivers

Line drivers shall transmit data at a minimum of 9600 bps over the distances, and be compatible with the selected or existing wireline modems and

telecommunications equipment that is operational at the installation.

2.2 WIRELINE CABLE

Wireline cable shall be insulated solid copper type conforming to the following specifications. A minimum of No. 22 AWG shall be used for all applications. All interior cables' insulation and jacketing material shall not contain any poly vinyl chloride (PVC) compounds.

2.2.1 Cable Construction

All cable components shall be able to withstand the environment the cable is installed in for a minimum of 20 years.

2.2.2 Underground Cable

Underground cable as specified in ICEA S-84-608 covers mechanical and electrical requirements for filled, polyolefin insulated, copper conductor telecommunications cable. It provides alternative choices for type of insulation, type of filling compound, core lay-ups, color code, sheath design (shielding materials, single or double jackets, and jacket thickness), and screened or non-screened core.

2.2.3 Interior Cable

Interior cable, as specified in NFPA 70 covers mechanical and electrical requirements for filled, polyolefin insulated copper conductor communications cable. It provides alternative choices for type of insulation, type of jacket, filling compound, core lay-ups, color code, sheath design (shielding materials, single or double jackets, and jacket thickness), and screened or non-screened core. All interior cables' insulation and jacketing material shall not contain any poly vinyl chloride (PVC) compounds.

2.3 RACEWAY SYSTEMS

Raceway systems as specified in Section 16415 ELECTRICAL WORK, INTERIOR and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND shall be furnished and installed.

2.4 ENCLOSURES

Enclosures shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. The Contractor shall provide metallic enclosures to house the wireline DTS equipment. The enclosures shall be as specified or shown.

2.4.1 Interior

Enclosures to house wireline DTS equipment in an interior environment shall meet the requirements of NEMA 250, Type 12.

2.5 MESSENGER CABLE

A messenger cable system to support all aerial cable shall be furnished and installed. The messenger system shall include all guys, hardware and appurtenances needed to install the messenger cable. The messenger system shall be capable of supporting the weight of the DTS cable with the required messenger cable tensioning without exceeding 30 percent of its rated breaking strength under 16 degrees C conditions of no ice and no wind. The messenger shall be sized so that ice and wind loading normally encountered at the site does not cause the messenger to exceed 50 percent of its rated breaking strength. All appurtenances, guys, and hardware shall be sized to exceed the required strength of the messenger cable. Messenger cables shall be galvanized zinc coated steel or aluminum clad steel.PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with the manufacturer's instructions. All necessary interconnections, services, and adjustments required for a complete and operable data transmission system shall be provided. Loading coils shall not be installed on cables provided for use with line drivers.

3.1.1 Enclosure Penetrations

Enclosure penetrations shall be from the bottom unless the system design specifically requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.1.2 Interior Electrical Work

Except as otherwise specified, interior electrical work shall be installed as specified in Section 16415 ELECTRICAL WORK, INTERIOR. In locations where corrosion and soil conditions are a concern, Contractor shall seek approval from Government before using steel or rigid galvanized conduit.

3.1.3 Exterior Electrical Work

3.1.3.1 Underground

Except as otherwise specified, underground electrical and communications work shall be installed as specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

a. Minimum burial depth for cable shall be 762 mm , but not less than the depth of the frost line.

b. Where direct burial cable will pass under sidewalks, roads, or other paved areas, the cable shall be placed in minimum 25 mm diameter zinc

coated steel, rigid galvanized, or schedule 40 conduit or concrete encased PVC. Conduit may be installed by jacking or trenching, as approved.

c. All buried cable shall be placed below a minimum 76.2 mm wide plastic warning tape buried in the same trench or slot. The tape shall be 300 mm above the cable. The warning tape shall be continuously imprinted with the words "WARNING - COMMUNICATION CABLE BELOW" at not more than 1.2 m intervals. The plastic tape shall be acid and alkali resistant polyethylene film, 7.62 mm wide with a minimum thickness of 102 micrometers . Tape shall have a minimum strength of 12.1 MPa lengthwise and 10.3 MPa crosswise.

d. Splices shall be installed in cable boxes. A cable length of at least 1 m shall be provided in each splicing location for future cable relocation, splicing, and re-racking. All splice enclosures (manholes, handholes, above-ground pedestals, etc.) shall have a length, width, and depth of at least twice (2X) the initial size requirement ot accommodate future system work (i.e., splices). All cable ends shall be protected at all times with end caps except during actual splicing. During the splicing operations, means shall be provided to protect the unspliced portions of the cable from the intrusion of moisture and other foreign matter.

e. For cable installed in duct and conduit, a cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct and conduit as it is played off the reel. As the cable is played off the reel, it shall be carefully inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being "kinked" or "crushed." A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is played off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-cell instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall be such that the cable is not twisted or stretched.

3.2 TESTING

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

3.2.1 Wire Line Test

The Contractor shall test each wire line pair. The Contractor shall prepare reports containing test results and shall certify in the reports conformance to the following requirements.

3.2.1.1 Attenuation

Measurements shall be made with test tone of 1004 Hz at 0 dBm. Attenuation distortion not to exceed minus 3 dB to plus 12 dB from 300 to 3,000 Hz, and minus 2 dB to plus 8 dB from 500 to 2,500 Hz referenced to the attenuation of the 1004 Hz test tone. Attenuation at 1004 Hz of less than 40 dB.

3.2.1.2 Envelope Delay

Envelope delay distortion shall be no greater than 1,750 microseconds over a range of 800 to 2,600 Hz.

3.2.1.3 Insulation Resistance

Insulation resistance wire to wire of wireline pair of at least 16,093 megohm-km measured at 22 degrees C .

3.2.1.4 Loop Resistance

Loop resistance of less than 1,500 ohms.

3.2.2 Contractor's Field Test

The Contractor shall verify complete operation of the DTS during Contractor's Field Testing as specified in Section 16751. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 100,000 bits of data on each communication link and measuring errors. The bit error rate shall be not greater than 1 out of 100,000 for each link. The Contractor shall prepare a report containing results of the field test.

3.2.3 Verification Test and Endurance

The wire line data transmission system shall be tested during the Performance Verification Test and Endurance Test as specified in Section 16751.

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SECTION 16844

ELECTRONIC CARILLON SYSTEM

PART 1 GENERAL

1.1 SUMMARY

Electronic Carillon system shall be a factory fabricated assembly provided as specified herein and as required for a complete assembly. Carillon system shall include all hardware, control cabinet, amplifier, and speakers for a complete and usable system.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Electronic Carillon; G

Provide complete manufacturer's descriptive information package…

SD-10 Operation and Maintenance Data

Electronic Carillon, Data Package 1; G

Submit in accordance with Section 01701 OPERATION AND MAINTENANCE DATA.

1.3 QUALITY ASSURANCE

1.3.1 Manufacturer Experience

Manufacturer shall have a minimum of 5 years continuous production of Steeples using the materials and support systems specified.

1.3.2 Installer Certification/Experience

Personnel certified by the manufacturer and having at least 3 years of experience in the installation of electronic carillon systems shall perform installation.

1.3.3 Materials

Verify that all materials are free from defect and conform to approved shop drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

Electronic Carillon system and accessories shall be delivered to the job site in protective packaging. Store out of contact with the ground, protected from the weather and incidental damage from other trades. Store in a fully supported manner as recommended by the manufacturer to avoid damage. Damaged materials shall be replaced or repaired at the direction of the Contracting Officer.

1.5 WARRANTY

Provide manufacturer's written two year minimum warranty against defects in materials or workmanship.

1.6 OPERATIONAL REQUIREMENTS

The Electronic Carillon system shall be used to recreate the sound of ringing bells from the Steeple of the Chapel. The carillon shall be controlled through pushbuttons and a backlit LCD control screen. It shall have the following capabilities:

- 128 program points per day for each of seven days of the week
- 256 special program points
- Block programming of program schedules
- System software shall be field upgradable
- 4 individual program schedules, three of which have individualeffective date ranges
- 32 song libraries - 24 pre-defined, 12 customer definable
- Ability to store up to 1200 songs in internal non-volatile memory
- Up to 128 direct play lists
- Electronic volume control of up to 4 individual amplifier channels
- Traditional clock chimes for play at any quarter-hour time increment
- Four bells for tolling and pealing
- Automatic leap year switchover

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Control Cabinet

Control Cabinet shall house all electronics, amplifiers, monitor speakers, and electronic volume control.

2.1.2 Speaker Horns

Four rectangular speakers shall be weatherproof with 60-watt drivers and 250 feet UL Listed Class 2 cable. Speakers shall be located in the steeple as shown on drawings.

2.1.3 Amplifier

Amplifier shall be contained in Control Cabinet. Amplification shall be solid state, 200 Watts RMS, 400-Watts peak. Frequency response shall be +/- 1db, 20 - 20khz. Amplifier shall be protected from excess current damage and have three levels of EMP protection.

2.1.4 Hardware

Electronic Carillon system shall have large backlit graphical LCD screen for displaying and controlling all system functions. Built-in HELP menu shall be available at the touch of a button. All connections to external peripherals shall be made via Fiber Optic cable.

2.1.5 Digital Signal Processor (DSP)

Dedicated high-speed DSP shall run at 60 MHz and be capable of 48 note polyphonic output at 16 bit, 44.1 kHz, mono or stereo. DSP shall include 8 Meg of on-board permanent non-volatile memory. Eight bell voices shall be included that are generated from Digitally Sampled bells. Eight swinging bell voices shall be included with full Doppler effects, each with its' own swing rate. Eight tolling bell voices shall be included, each with its' own tolling rate.

2.1.6 Security

Security for the system shall be provided through a key operated lock switch, which prevents unauthorized tampering of system controls.

2.1.7 Radio Remote Control

Remote control shall be capable of operating at a distance of 300 feet from control cabinet and shall be able to control up to 16 individual system functions. Radio control shall operate in the 900 MHz frequency band and shall be battery operated.

PART 3 EXECUTION

3.1 WORKMANSHIP

Surfaces shall be kept free from grease, oil, dirt or other foreign materials and contaminants. Protect electronic carillon and all associated components from contact damage inducing dents, scratches, or distortion of shape. Do not install carillon system until damage is repaired to the satisfaction of the Contracting Officer.

3.2 INSPECTION

Verify site conditions and electrical connections are all installed and completed consistent with Electronic Carillon manufacturer requirements and approved shop drawings.

3.3 INSTALLATION

Coordinate with other trades to insure that personnel are available and materials are at hand to ensure a complete and successful installation. Coordinate with steeple manufacturer for space for speaker horns. Coordinate positioning of all components to ensure appropriate and unrestricted access for future maintenance activity. Conform to NPFA 70 for wiring.

3.4 COMMISSIONING

After installation is complete the contractor shall program the electronic carillon as directed by the Contracting Officer for initial setup of the system. The contractor shall demonstrate that the system functions to meet the manufacturer's standard.

3.5 TRAINING

The Contractor shall conduct a training course for the operating staff based on material provided from the Manufacturer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally complete. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate routine maintenance operations. A VHS format video tape of the entire training shall be submitted.

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