

MALMSTROM AFB DESIGN STANDARDS



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February, 2012

BASE DESIGN STANDARDS
23 February 2012
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MALMSTROM AFB BASE DESIGN STANDARDS
1 Jun 2011

1.0 GENERAL

1.1. Code Compliance: The designers shall comply with all applicable codes as defined in UFC 1-200-01. Interior and exterior material selection shall also be based on aesthetics, functions/use, and maintainability. Provide complete color boards with recommended manufacturers' names, product numbers, color numbers and actual material samples. Design shall comply with the engineering technical letters (ETLs) found at http://www.wbdg.org/ccb/browse_cat.php?o=33&c=125, construction technical letters (CTLs), and design documents referenced herein. Unless otherwise noted, these design standards do not apply to military family housing (MFH) projects. MFH projects designs shall be in compliance with all Air Force regulations including the Air Force Family Housing Design Guide, Base Housing Community Plan, Design Guide for Energy Efficient Revitalization and New Construction for Military Family Housing, and base directives. All current UFC can be located at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

1.2. Operations and maintenance manuals: (4 sets) of O&M manuals shall be furnished for all mechanical and electrical equipment. Specify a lockable metal wall cabinet be provided in the mechanical room for storage of one (1) set of O&M manuals. One electronic copy of the O&M manuals is to be provided to the Air Force in PDF format.

1.3. Safety Regulations: The contractor shall comply with all state and federal, OSHA, NOISH, and EPA regulations.

1.4. Presentations: Provide 35% presentation drawings and wing briefing as outlined in Appendix 1 for selected major projects or as required in the A-E statement of work.

1.6. General Specification Section: Include attached 01 00 00 General Requirements section in specifications. Reference Appendix 2.

1.7. Base Access Specification: Include attached 01 00 10 (Appendix 2) for base projects or 01 00 10 (Appendix 3) for WSA projects, security requirements section, as required, in specifications for contractor base entry requirements.

1.8. Renderings: Specify comply with architectural rendering requirements for MILCON projects as required in Appendix 1.

1.9. Energy Conservation: Energy conservation will be achieved through the use of high "R" roof insulation (minimum of R-38) and wall insulation (R-19), low "E" insulating glass windows in thermal break sash, insulated personnel doors with positive weather-stripping seal. Provide high efficiency mechanical/ventilation systems, rapid heat

recovery systems and energy monitoring and control systems to be installed and connected to existing base system. Specify power ventilation systems in cold attic spaces, where equipment is installed, to reduce summer heat load. Roof overhangs must be utilized. Comply with all mandated energy conservation executive orders and DOD directives.

1.10. Conceptual Schemes: Architect shall develop a minimum of two (2) architectural concepts with elevations for the facility. Enhanced computer renderings using digital photographs will be acceptable. Submittal schemes shall be subject to the review and approval of the user and base civil engineer.

1.11. ADA Requirements: Comply with the memo (Access for People with Disabilities) sent out by the Deputy Secretary of Defense dated October 31, 2008. See Appendix 7. This memo requires the DOD to meet the requirements of the Architectural Barriers Act of 1968 (ABA). But as a matter of policy the DOD is to meet the more stringent of either the Uniform Federal Accessibility Standards (49 FR 31528) or the 1991 version of the Americans with Disabilities Act Accessibility Guidelines.

1.12. Drawings Formats: All project drawings will be AutoCAD 2010 generated, word processing will be Microsoft Word 2007 (**conversion from other software is not acceptable**); and spreadsheets will be Excel 2007. If fonts or software other than standard release 2007 are used, the designer will provide a copy of the software with the bid documents. All specification sections, including mechanical and electrical, will be in the same font and style. Each final product drawing shall be functionally complete to include all layers, fonts, and menus. The designer is required to utilize AIA CAD layering guidelines. All project documents shall be submitted in electronic form (CD).

1.13. Base Pass: All contractor personnel are required to have a base pass, which is obtained as directed by the contracting officer and as required by the base security police.

1.14. Base Road Damage: For all projects having heavy truck equipment traffic, include the following in the design:

1.14.1. A designated haul/access route on the plans.

1.14.2. Designated fenced staging area and fenced construction area.

1.14.3. Staging and site areas shall be restored to original condition at the end of the construction contract.

1.14.4. Specify load limits as follows (shall apply to all contractor-operated equipment on base):

April 1 to June 1	--	350 #/inch width of tire
All Other Times	--	400 #/inch width of tire

1.15. AT/FP Requirements: All designs must meet UFC 4-010-01 and supporting UFC as referenced in UFC 4-010-01.

2.0 ARCHITECTURAL

2.1 General Guidelines:

- Use simple building shapes with façade proportions that are integrated surrounding or like facilities.
- Use clean and simple details, such as soldier coursing bricks or using fenestration design to relate buildings to one another.
- Use building materials that are easy to maintain.
- Avoid introducing uncommon, trendy or different types of materials unless it is a special facility such as the Community Activity Center. Use of these types of materials will require approval from the Wing Commander.
- Utilitarian equipment, such as electrical transformers, air conditioning condensers, etc., shall be screened from view using materials that are compatible with the surrounding area. Options include vinyl fence, split face CMU, brick, synthetic stone or a combination of these items.
- All roof drains shall be discharged into underground storm sewers where available.
- Utility lines shall be buried underground whenever possible.

2.2 Materials By Area:

2.2.1 – Operations Buildings:

1. Exterior Walls:

Concrete Masonry Units (CMU) as manufactured by Amcor, Inc., Idaho Falls, Idaho or Fagenstrom Company, Great Falls, MT, in split-face or fluted finish, manufactured using all white cement and carefully selected aggregates in order to produce an “Antique Linen” coloration that meets prior approval of the Base Civil Engineer (BCE). Or;

Exterior Walls:

Metal Cladding. Color: Fed. Std. No. 23578, Antique Linen. A wainscot of Concrete Masonry Units (CMU) as manufactured by Amcor, Inc., Idaho Falls, Idaho or Fagenstrom Company, Great Falls, MT, in split-face or fluted finish can be used as an accent.

2. Roofing:

Standing seam, anodized aluminum or steel with baked-on finish (with matching coil-stock flashings). Color: Federal Standard color No. 37056, except on buildings that have a pre-defined color scheme. See Section 2.6.

3. Fenestration:

- a. Windows: Insulated windows and storefronts are to have dark bronze anodized aluminum frames and be of high commercial quality with thermal break, low “E” glazing, and screens for operating sash. Force Protection Requirements for glazing shall be incorporated in all projects. Color: Fed. Std. No. 37056
 - b. Steel doors and frames: Provide steel doors and frames equal to Republic, painted to match Sherwin-Williams No. SW37056, except on buildings that have a pre-defined color scheme.
4. Gutters & Downspouts, Metal Copings & Flashing:
Gutters, metal copings and flashing will be baked-on finish, gutters to match roof and/or fascia; downspouts to match walls.

2.2.2 – Administrative Buildings:

1. Exterior Walls:
 - a. Brick (preferred) as manufactured by Denver Brick Company, Castle Rock Co., or Hebron Supply Company, Billings, MT., in matte or wire finish, and of the Denver Brick color “Desert Tan.”
 - b. CMU and concrete - as manufactured by Amcor, Inc., Idaho Falls, Idaho or Fagenstrom Company, Great Falls, MT, in split-face or fluted finish, manufactured using all white cement and carefully selected aggregates in order to produce an “Antique Linen” coloration that meets prior approval of the Base Civil Engineer (BCE).
 - c. Concrete and precast concrete (Lintels, copings, etc.) shall be integrally colored or stained to match building color scheme.
 - d. Insulated metal panels in an “Antique Linen” coloration.
2. Roofing:
 - a. Standing seam, anodized aluminum or steel with baked-on finish (with matching coil-stock flashings). Color: Federal Standard color No. 37056, except on buildings that have a pre-defined color scheme.
 - b. Fiberglass shingles: ASTM D 3462 and as follows: Laminated-Strip Asphalt Shingles: Laminated, multi-ply overlay construction, mineral-granule surfaced, and self-sealing. Straight cut butt edge. Products: “Landmark Plus Shingles”, as manufactured by CertainTeed Corporation or equivalent. Shingles shall weigh no less than 260 pounds per square with Upgraded Wind Warranty for 90 MPH Winds and shall bear a Class “A” fire-rating label. Use of fiberglass shingles in lieu of a standing seam metal roof will only be allowed on facilities that are constructed within or adjacent to housing areas.
 - c. Use of other roof types must be approved by the BCE.
3. Fenestration:
 - a. Windows: Insulated windows and storefronts are to have dark bronze anodized aluminum frames and be of high commercial quality with thermal break, low “E” glazing, and screens for operating sash. Force Protection

Requirements for glazing shall be incorporated in all projects. Color: Fed. Std. No. 37056

- b. Steel doors and frames: Provide steel doors and frames equal to Republic, painted to match Sherwin-Williams No. SW37056, except on buildings that have a pre-defined color scheme.
- 4. Gutters & Downspouts, Metal Copings & Flashing:
Gutters, metal copings and flashing will be baked-on finish, gutters to match roof and/or fascia; downspouts to match walls.

2.2.3 – Community Buildings:

- 1. Exterior Walls:
 - a. Brick (preferred) as manufactured by Denver Brick Company, Castle Rock Co., or Hebron Supply Company, Billings, MT., in matte or wire finish, and of the Denver Brick color “Desert Tan.”
 - b. CMU and concrete - as manufactured by Amcor, Inc., Idaho Falls, Idaho or Fagenstrom Company, Great Falls, MT, in split-face or fluted finish, manufactured using all white cement and carefully selected aggregates in order to produce an “Antique Linen” coloration that meets prior approval of the Base Civil Engineer (BCE).
 - c. Lamina-protected Exterior Insulated Finish System (EIFS).
 - d. Precast synthetic stone used as a wainscot or an accent.
- 2. Roofing:
 - a. Standing seam, anodized aluminum or steel with baked-on finish (with matching coil-stock flashings). Color: Federal Standard color No. 37056, except on buildings that have a pre-defined color scheme. Use of other roof types must be approved by the BCE. See Section 2.6.
 - b. Fiberglass shingles: ASTM D 3462 and as follows: Laminated-Strip Asphalt Shingles: Laminated, multi-ply overlay construction, mineral-granule surfaced, and self-sealing. Straight cut butt edge. Products: “Landmark Plus Shingles”, as manufactured by CertainTeed Corporation or equivalent. Shingles shall weigh no less than 260 pounds per square with Upgraded Wind Warranty for 90 MPH Winds and shall bear a Class “A” fire-rating label.
 - c. Use of other roof types must be approved by the BCE.
- 3. Fenestration:
 - a. Windows: Insulated windows and storefronts are to have dark bronze anodized aluminum frames and be of high commercial quality with thermal break, low “E” glazing, and screens for operating sash. Force Protection Requirements for glazing shall be incorporated in all projects. Color: Fed. Std. No. 37056.
 - b. Steel doors and frames: Provide steel doors and frames equal to Republic, painted to match Sherwin-Williams No. SW37056, except on buildings that have a pre-defined color scheme.
- 4. Gutters & Downspouts, Metal Copings & Flashing:

Gutters, metal copings and flashing will be baked-on finish, gutters to match roof and/or fascia; downspouts to match walls.

2.2.4 – Dormitories:

1. Exterior Walls:

- a. Brick (preferred) as manufactured by Denver Brick Company, Castle Rock Co., or Hebron Supply Company, Billings, MT., in matte or wire finish, and of the Denver Brick color “Desert Tan.”
- b. CMU and concrete - as manufactured by Amcor, Inc., Idaho Falls, Idaho or Fagenstrom Company, Great Falls, MT, in split-face or fluted finish, manufactured using all white cement and carefully selected aggregates in order to produce an “Antique Linen” coloration that meets prior approval of the Base Civil Engineer (BCE) or stained to match Fed Std. No. 37056.
- c. Lamina-protected Exterior Insulated Finish System (EIFS).
- d. Stucco

2. Roofing:

- a. Standing seam, anodized aluminum or steel with baked-on finish (with matching coil-stock flashings). Color: Federal Standard color No. 37056, except on buildings that have a pre-defined color scheme. Use of other roof types must be approved by the BCE. See Section 2.6.
- c. Use of other roof types must be approved by the BCE.

3. Fenestration:

- a. Windows: Insulated windows and storefronts are to have dark bronze anodized aluminum frames and be of high commercial quality with thermal break, low “E” glazing, and screens for operating sash. Force Protection Requirements for glazing shall be incorporated in all projects. Color: Fed. Std. No. 37056.
- b. Steel doors and frames: Provide steel doors and frames painted to match Sherwin-Williams No. SW37056, except on buildings that have a pre-defined color scheme.

4. Gutters & Downspouts, Metal Copings & Flashing:

Gutters, metal copings and flashing will be baked-on finish, gutters to match roof and/or fascia; downspouts to match walls.

2.3. Signage: Interior and exterior signs will be provided in each new building project or renovation and be in accordance with the most current version of UFC 3-120-01, Air Force Sign Standard and Headquarters AFGSC guidance.

2.4. Material Installation: All finishes are to be installed according to manufacturers’ instructions and properly maintained as per manufacturers’ warranty specifications.

2.5. Flooring: Floor finishes are to be appropriate for the function of the space as well as aesthetically appropriate. Acoustical properties of floor finishes have great impact on noise levels, and the colors of the finishes impact the lightness or darkness in spaces.

Extremely light colors, especially white, should be avoided in high traffic areas due to soiling and possible glare. Floor patterns or changes in floor finishes may be used to create circulation paths or separation between spaces.

There are three basic categories of floor coverings that can be used:

- Hard surfaces – concrete, wood, stone, ceramic, and terrazzo
- Resilient surfaces – vinyl composition tile, sheet vinyl, rubber, and linoleum
- Soft surfaces – carpet and area rugs

Concrete

Interior concrete finishes that can be used are painted, stained, or glazed.

Wood

Wood flooring is typically an expensive upgraded finish that is applied in special areas. Hardwoods, such as oak and maple and engineered hardwoods are the only types of wood flooring that can be used.

Stone

Acceptable stone floors include slate, granite, marble, and travertine among others.

Any color is acceptable with approval. Acceptable finishes include:

- Polished finish – requires high maintenance, has poor slip resistance, and should not be used in heavy traffic areas, especially adjacent to building entrances.
- Honed finish – has a dull, smooth finish with good slip resistance.
- Thermal finish – has a great deal of texture and is very slip resistant.

Typically only used in special areas.

Ceramic Floor Tile

The types of ceramic tiles available are mosaic, quarry, and paver. The following applies to using ceramic tile:

- In heavy traffic areas, such as vestibules and shopping mall corridors, a quarry, paver, or heavy duty porcelain tile is recommended.
- A mottled or shaded tile camouflages stains and is easier to maintain than an overall flat color.
- Mosaics are small tiles that are typically less than 1" wide and can be used for intricate designs and patterns. Webbing may be applied to the back of the tile for easy installation.
- Quarry tiles are thick and durable. These are usually installed in heavy traffic areas such as commercial kitchens.
- Pavers are larger tiles that are typically found with textured surfaces. These tiles may be installed with a cement-based mortar in a thick set or thin set method; the thin set method is most preferred. The thick set method works well where slopes and drains are desired.

Vinyl Composition Tile (VCT)

Vinyl composition tile is an economical floor covering that is easy to install, clean, and repair. The following applies to VCT:

- 12" x 12" (305 mm x 305 mm) tile, 1/8" (3.2 mm) gauge, pattern to go full depth of tile.
- "No wax" finishes should be limited to residential or light traffic wear.

Sheet Vinyl

- Vinyl sheet flooring is produced in large sheets to allow for few joints.
- Minimum of .085" (2.16 mm) gauge, pattern to go full depth of wear level (.50" or 1.27 mm).
- "No wax" finishes should be limited to residential or light traffic wear.
- Only heat welded seams are allowed. Chemical welded seams are not allowed.

Linoleum

Linoleum is a natural product that is made up of linseed oil, cork, and wood flour. These materials combined provide a durable finish with superior thermal and acoustic properties. Linoleum can be purchased in sheets or large tiles in a variety of colors, and unlimited patterns can be created.

Carpet

The following apply when selecting and installing carpet:

- See ETL 07-04 Air Force Carpet Standards for all facilities.
- Provide reducers, metal strips, or other edging in areas where carpet abuts other floor surfaces.
- Patterned carpets help to "mask" soiling in traffic areas. Choose patterned carpets with distinguishable designs of two or more different colors. Tone on tone color combinations do not hide soil. Solid colored carpets should only be placed in commanders' suites, chapels, DV suites and family housing units.

The preferred carpet is as follows but is not restricted to these:

Residential – Use a nylon cut pile, 24 to 28 ounce carpet for normal use.

- High end carpets should be a nylon cut pile, 34 to 36 ounce.
- Pad should be a foam pad 3/8" thick and 5 pounds
- High end pad should be a foam pad 7/16" thick and 7 pounds

Commercial – Style Name – Constellation EW24

- Style Number – 59326
- Fiber Product – Nylon
- Construction – Pattern loop
- Finish pile Thickness - .099 inches
- Density – 8727 oz/Cuyd
- Flammability – ASTM E-648 Class 1

ASTM E-622 NBS Smoke Chamber less than 480.

Any carpeted stair treads are to have a wrapped nose versus a waterfall wrap.

2.6 Interior Wall Finishes:

Gypsum Board

Gypsum board (also known as sheet rock or drywall) is installed as the wall substrate in most commercial interior projects. Typically a Type "X" gypsum board is used when a fire rating is required. Other types of gypsum board include that can be used are green

board or moisture resistant gypsum board. However in wet areas a cement or fiberboard material is the preferred substrate. Interior administrative and commercial wall spaces using a gypsum wall will have a level 4 finish with a light orange peel texture. Specifications for gypsum board assemblies shall reference GA 214-90.

Vinyl Wall Coverings

Fabric-backed and paper-backed vinyl wall coverings are a good low maintenance option and can be used as an architectural accent. Fabric-backed wall coverings are the most durable. Vinyl wall coverings come in three types, Type I, II, and III. Type I is less durable, and therefore, used in lower traffic areas. Type II is used in heavier traffic areas such as corridors and public spaces. Type III is the least used due to its high cost and limited applications, but is excellent for walls that take extreme abuse. The following applies to vinyl wall coverings:

- When installing wall coverings over CMU, first fill grooves, then prep each surface with a skim-coat of plaster, or as specified by the manufacturer.
- Vinyl wall coverings and paneling used in corridors, stairs, fire exits, or sleeping rooms, must have "Class A" fire ratings. See NFPA 101, 6-5.3.5.

Paint

Paint is the most common wall finish. Paints come in two options: latex (water based) and oil (solvent based). For environmental reasons all paints should be latex unless there is no latex option for a particular application.

Paint is produced in four basic sheens:

- Flat or matte finish – produces the least glare but is also the least durable. This finish is applied in low traffic areas.
- Satin or eggshell finish – has a light sheen and is more durable than the flat finish. This is the preferred wall finish.
- Semigloss finish – has a good sheen and is yet even more durable. Apply to areas that required frequent cleaning, such as kitchens, bathrooms, door trims and moldings.
- Gloss finish – has a very shiny appearance and is very durable. It is difficult to apply a new finish over gloss.

Avoid stark white as a color choice for paint. The base specifications will require paint finishes to have a primer coat and two coats of paint. Painted CMU is not acceptable as an interior wall finish, except in utility areas, as approved by the BCE.

Ceramic Wall Tile

There are several options of glazed and unglazed ceramic tiles for surfacing walls. Wall tiles have low impact resistance and are typically glazed. Install tiles from floors to ceilings on wet walls, such as showers, and at least wainscot height behind lavatories and toilets is preferred. Use a cement or fiberboard for the substrate on all tile surfaces.

Wood Paneling

Wood paneling is used only in upscale spaces. Wood veneer wall coverings give the look without the expense of wood paneling. The veneer can be installed finished or unfinished. Exposed edges of wood paneling at chair rails (30" to 32" on center) or at

wainscot (42” to 48”) heights should be finished with wood trim moldings stained to match paneling. Do not use imitation wood finishes, paper, or vinyl top applications to simulate wood. Wood paneling must have the appropriate wall and ceiling fire classifications to meet NFPA 101 requirements for the areas in which they are used.

2.7 Ceiling Finishes:

There are several materials that may be used for ceilings, such as hardwood, reinforced concrete, metal, drywall, and acoustical tile depending upon the use of the facility and/or area.

Acoustical Tiles

Acoustical ceiling tile (ACT) is a mineral fiber board that is the preferred ceiling material on base. It works well with H.V.A.C. systems; provides easy access to above areas; provides noise reduction properties, and provides light reflectance properties. Some available options include: anti-microbial solutions, fire resistances, a variety of styles, i.e., tegular tiles, scored, flat lay-in, and textured, and they may come in a selection of colors. The following apply to acoustical tiles:

- Use 2’ x 2’ size when replacing ceiling systems or in new construction.
- Tiles can be installed directly onto a finished surface, or suspended from a metal grid.
- Suspension systems can be exposed, semi-exposed, or concealed depending on the desired look, but typically should not be in contrasting colors.
- Suspended acoustical tile systems should not be used in family housing.
- Purchase additional ceiling tile stock to have on hand for replacement.

Gypsum Board

Gypsum board ceilings are common in lots of construction on base. They may have a smooth finish or be textured with a thin layer of plaster for visual interest and to improve acoustical performance. Gypsum board is applied directly to wood or metal frame systems. The boards are usually 4’ x 8’ and the seams are finished off with a tape and float process. Surfaces are to be painted may be painted.

Reinforced Concrete Ceilings

Reinforced concrete ceilings look industrial due to the exposure of the structure, ductwork, lighting systems, and sprinkler systems. These exposed areas may be painted neutral or nondescript colors so that they “blend” with the concrete for a uniform appearance. This works well in spaces where there is a great deal of activity at eye level such as dining facilities or retail environments. Other spaces may benefit from an emphasis played on ceilings, and therefore, contrasts in colors and materials should be used.

Metal Ceilings

Metal ceilings are typically decorative and are installed as ceiling systems. There are several options available including linear metal, reflective surfaces, open plenum, and stamped metal panels.

Wood Ceilings

Wood can be used to give a rustic lodge look, or a planked ceiling look. Options for wood ceilings include paneling, siding, and wood planks. Wood ceilings must have flame spread index ratings of 25 or less.

2.8 Window Treatments:

When considering solar protection, there are many options: vertical or horizontal blinds, shades, and drapery. All window treatments, including lining materials, must be fire rated. Window coverings for all sleeping areas in lodging should have separate soft-suede blackout linings to block out sunlight. Colors and patterns of window treatments are to be coordinated with interior color schemes. See NFPA 101, 6-6 for fire safety considerations.

2.9 Hardware:

Hardware should be chrome brushed aluminum, anodized bronze or antique brass for ease in maintenance. Polished brass surfaces require frequent maintenance. Nonconforming hardware should be replaced during renovations or as the budget allows. The colors and tone of electrical switch plates, electronic devices, and light switches should “blend” with the adjacent surface, i.e., light colors on light, dark colors on dark.

2.10. Locksets: Locksets shall be keyed to the base’s “Best/Falcon” lock system with a grand master, master key system. All base facility locks shall be seven-pin equal to base standard lock system (Best/Falcon or equal). Specify type “A” keyway for the base facilities and type “M” keyway for missile alert facilities (MAFs). Keying schedule shall be a submittal item in the construction contract. Specify contractor to provide biting list. Contractor shall supply three (3) keys for each room lock set and ten (10) keys for each exterior entrance door. All exterior doors shall be keyed alike except for the mechanical room door, which shall be keyed to the base master key system. Provide electronic card lock system (Onity or approved equal) for all interior and exterior locking doors in dormitories except mechanical rooms, telephone rooms, and electrical panel rooms.

2.11 Fire Extinguishers:

Fire extinguishers should be placed in metal cabinets that are flush or partially recessed into walls and are clearly identified with the words “fire extinguisher.” Fire extinguishers hanging on walls from hooks are not acceptable. Signs for fire extinguishers or fire notices/exits, etc. and alarm fixtures themselves do not have to be in the color red.

2.12. Color: The designers shall comply with all applicable codes in their selection of interior/exterior materials and finishes. Interior and exterior material selection shall also be based on aesthetics, functions/use, and maintainability. Provide complete color boards with recommended manufacturers’ names, product numbers, color numbers and actual material samples. Base exterior paint, masonry, and metal siding colors shall be

Antique Linen, federal standard color #23578, for main building, and Dark Brown, federal standard color #37056, for trim and standing seam metal roofs. Although the main building must be antique linen, the building base, window sills, lintels, horizontal banding, metal roof and other accents should be dark brown. Deviations are approved on a case by case basis. Exterior paint materials shall be long-life coatings consisting of baked-on factory finish where available, powder coatings, and/or two component modified polyurethane coatings approved by the BCE. The above standards must be matched to retain uniformity across the base.

2.13. Roof Systems: New roof systems on existing and new buildings in the base cantonment area shall be a standing seam metal system with baked-on 20-year finish, insulated with metal subdeck. New roof systems on existing and new buildings in other base areas and where specifically approved, shall be fully adhered, single ply, fire rated EPDM, 60 mil thickness using UFGS 07 53 23, Ethylene Propylene Diene Monomer Roofing (EPDM). Design/warranty system shall be based on 90-mph wind uplift resistance. Insulation for both roof systems shall be polyisocyanurate rigid board applied in multiple layers. Specify minimum 5-year contractor labor and material warranty and 15-year manufacturer's finish and labor, material, weather-tightness warranty. Installer shall apply and obtain the roof manufacturer's certification and warranty.

2.14. Roof Accessories:

- a. Provide continuous bar style snow stops, with bases secured to the standing seam with non-penetrating fasteners, on all eaves of metal roof system.
- b. Provide snow/ice melt heating cable system with GFI protected thermostatic controls in all gutters and downspouts on building. Connect downspouts to storm drain system. If storm drain connection is not possible, provide approved concrete splash blocks at downspout discharge. Layout of splash blocks shall provide positive drainage away from foundations for 10 feet minimum.

2.15. Ground mounted equipment: Ground mounted equipment such as transformers, A/C condensers, and dumpsters shall be located on concrete pads, away from public access, and fully screened from public view using approved materials to match exterior building finish and colors.

2.16. CMU Sealing: Seal all exterior split-faced CMU block surfaces using minimum two (2) coats of an approved siloxene or silicon waterproofing.

2.17. Exterior Doors: Exterior personnel doors shall be designed with appropriate swing and with heavy-duty hardware, stops, etc., to prevent damage from prevailing wind conditions. Door stops are to be located as to not interfere with facility egress from this door or any adjacent door.

3.0 STRUCTURAL/GEOTECHNICAL

3.1. Applicable Regulations: Applicable regulations include but are not limited to:

- UFC 3-220-01A – Deep Foundations
- UFC 3-220-01N Geotechnical Engineering Procedures for Foundation Design of Building and Structures
- UFC 3-220-07 – Foundations in Expansive Soils
- UFC 3-301-01 – Structural Engineering, with Change 2
- UFC 3-310-04 – Seismic Design for Buildings with Change 1
- UFC 3-320-03A – Structural Considerations for Metal Roofing, with Change 2
- UFC 3-320-06A – Concrete Floor Slabs on Grade subjected to Heavy Loads
- UFC 4-010-01 – DoD Minimum Antiterrorism Standards for Buildings, includes Change 1
- UFC 4-010-02 – DoD Minimum Antiterrorism Standoff Distance for Buildings (FOUO), includes Change 1
- 2009 IRC
- 2009 IBC

3.1. Foundation: All new foundation systems will be designed based on geotechnical investigations of the site and shall be of reinforced concrete. Evaluation will include geotechnical testing to determine existing soils and foundation parameters. Since all areas of the base are susceptible to problems caused by expansive clays, consideration of this fact must be taken into account for all foundation, pavement and utility systems design. Foundations will extend below frost depth, typically six (6) feet below grade. A drilled pier and grade beam system is the preferred foundation system. No other type of foundation system can only be installed unless prior approval is received from Malmstrom's Chief of Programs.

3.2. Soils: Typical soil profile is montmorillonitic clays with moderate-to-severe shrink-and-swell potential with surface layer of wind blown sand occurring in isolated areas of the base. Sands range from 0 to approximately 10 feet thick. Bedrock is Kootenai shale and occurs from about 40 feet to over 100 feet below surface. All areas of the base are susceptible to problems caused by expansive clays. Soil pH average 7.9 on the base. Soil resistivity averages 2,000 ohms/cubic centimeters.

3.3. Water Table: Perched water varies throughout the base, from 2-3 feet to 10 feet or more below the surface in sand lenses. Ground water will also collect and flow within existing utility trenches. This perched water will necessitate dewatering for footing/foundation work. Include provisions in the project documents for site dewatering and foundation drain systems tied to existing storm drainage system where available. If storm drain system is not available, use sump pump. Provide for foundation system waterproofing in the project documents.

3.4. Design Loads: All loads (i.e., seismic, wind, snow, etc): Design loads shall be based on occupancy Category 1, Table 1, ANSI A58.1-1982. Wind and snow loads

shall also be in accordance with ANSI A58.1-1982. Wind loads shall be based on a design wind speed of 90 mph, exposure C. Ground snow load is 40 psf. Roof snow load shall be based on a ground snow load of 30 PSF + drift. The minimum roof live load is 30 PSF. Seismic design shall be in accordance with AFMAN 32-1149, for specified seismic zone. Structural design including wind and seismic must also meet the requirements of the current IBC and Air Force directives in place at the time of award of the project. Light poles and light-supporting structures shall be designed to withstand wind of 100 mph in accordance with MIL-HK BK-1190. Specify force protection design requirements be incorporated on facilities in accordance with UFC 4-010-01 and UFC 4-010-02, available at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

4.0 Roads, Parking Lots & Traffic Control

4.1. General: Reference Appendix 9 for base standard construction details.

4.2. Design Standards: Applicable regulations are

- UFC 3-250-01FA - Pavement Design for Roads, Streets, Walks, & Open Storage Areas
- UFC 3-250-18FA, General provisions and Geometric Design for Raods, Streets, Walks, and Open Storage Areas
- UFC 3-250-03 - Standard Practice Manual for Flexible Pavements,
- UFC 3-250-04 – Standard Practice for Concrete Pavements, with Change 2
- UFC 3-250-06 - Repair of Rigid Pavement
- UFC 3-260 - series for any airfield design.
- Better Military Traffic Engineering SDDCTEA Pamphlet 55-17
- Manual on Uniform traffic Control Devices for Streets and Highways published by the US Department of Transportation,
- MTMCTEA Pamphlet 55-8 - Traffic Engineering Study Reference
- MTMCTEA Pamphlet 55-10 - Traffic Engineering for Better Roads
- MTMCTEA Pamphlet 55-14 - Better Traffic Engineering for Signs and Markings.
- ASSHTO

Unless otherwise specified the typical design vehicle is a WB-50. Pavements shall be designed for light vehicle traffic. Pavements trafficked by refuse or delivery trucks shall be designed for heavy vehicle traffic. Construct new parking lot and paved access road to standard design, with separation from the front of the building. Parking lots will allow for removal of snow and ice. Provide combination concrete curb and gutter around entire perimeter of parking lots and driveways. A typical road section on Malmstrom has 4" asphalt concrete pavement, over 4" thick base course, over 8" sub-base course.

4.3. Geotextiles & Geogrids: Use of a geotextile for separation is required on all roadways and parking lots and the use of a geogrid is recommended. If the section

profile allows for multiple lifts the geogrid should be installed after the installation of the first lift otherwise install the geogrid on top of the geotextile.

4.4. Streets, parking lots, and bike paths: The street system must provide convenient and safe access and circulation (including collections, deliveries, snow removal, and fire protection), complying with, AASHTO's "A Policy on Geometric Design of Highways and Streets" and Better Military Traffic Engineering SDDCTEA Pamphlet 55-17. Street design shall also conform to local and state criteria and the Air Force Family Housing Guide.

4.5. Curbs and Gutters: Streets shall be provided with standard integral barrier concrete curbs and gutters. Minimum curb radii at intersections shall be 20 feet. Curbs shall be depressed at entrances to driveways; all gradients shall provide positive drainage (no ponding). Curbs and gutters shall be as shown in the base construction standard details (Appendix 9).

4.6. Sidewalks: Sidewalks should be a minimum of 5 feet wide. House walks and street walks shall be of concrete with a minimum nominal thickness of 4 inches and shall be poured over a minimum 4-inch compacted granular base course.

4.7. Street Signs and Traffic Control: Street name and traffic control signs shall be provided at all street intersections and shall conform to requirements of the Better Military Traffic Engineering SDDCTEA Pamphlet 55-17, AFP 88-40, and the manual of Uniform Traffic Control Devices for Streets and Highways. Street names will be provided by the contracting officer.

4.8 Roadway Alignment/Access, Pedestrian Safety & Parking Design: All designs must be in compliance with the following design guides: Better Military Traffic Engineering SDDCTEA Pamphlet 55-17, and AASHTO's "A Policy on Geometric Design of Highways and Streets".

4.9. Construction Site Limits: Contractor's activities are to be restricted to the area determined on plans as "construction limits." The contractor is to fence the construction site in using 6 foot chain link fencing unless prior permission to use another material is given by the base's project engineer. A contractor staging area shall be designated by the contracting Officer.

5.0 WATER SUPPLY:

Water for the base is supplied by the city of Great Falls and is distributed throughout the base by the base-owned water distribution system. New facilities shall connect to the nearest adequately sized water main. The new line(s) shall be sized to meet fire protection and occupant usage.

5.1. Design Standards: The system shall comply with the design requirements in:

- UFC 230-07A - Design: Water Supply: Sources and general Considerations

- UFC 3-230-03A – Water Supply
- UFC 3-230-04A – Water Distribution
- UFC 3-230-09A – Water Supply: Water Storage
- UFC 3-230-10A – Water Supply: Water Distribution
- UFC 3-230-19N – Water Supply Systems
- MIL-HDBK-1005/7A – Water Supply Systems
- ETL 04-5
- MDEQ Circular DEQ 1
- Montana Public Works Standard Specifications
- Where there is a conflict between regulations the more stringent will apply.
- Fire Protection systems will be designed to meet UFC 3-600-01, NFPA 13, and NFPA 409.

Water and sanitary sewer system designs shall be reviewed by Montana Department of Environmental Quality for approval. Design calculations and testing results shall be submitted to the BCE as required or requested.

5.2. Back-Flow Prevention Devices: As required by AFI 32-1066 and UFC 3-600-1.

5.3. Flow Requirements: Total domestic requirements will be determined for average daily, peak daily, and fire flow requirements. System design shall provide a minimum residual pressure of 20 psi at each fire hydrant. All plugs, caps, tees, bends, and hydrants on water mains and hydrant laterals shall be provided with reaction backing or movement prevented by attaching metal tie rods or clamps. Metal tie rods are not to be used on plastic pipe. Fire hydrant flow requirements must meet MIL Handbook 1008C, Chapter 5.

5.4. Mains: Water distribution mains shall be looped and be of adequate size to satisfy both domestic and fire flow requirements. No mains shall be less than 6 inches in diameter. Dead ends up to 300 feet long are permitted if terminated by fire hydrants or flushing hydrants.

5.5. Depth: New mains will be installed with a minimum cover of 6'-6".

5.6. Changes in Alignment:

5.6.1. Thrust restraints are required at all changes in alignment exceeding 10°, at all dead ends and on fire hydrants. Thrust restraints shall be constructed as shown in Montana Public Works Standard Specifications standard drawing No. 02660-1. Wrap pipes and fittings in plastic before pouring thrust blocks.

5.6.2. The maximum deflection at joints shall not exceed the pipe manufacturer's recommendations.

5.7. Separation from Sewers:

5.7.1. There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.

5.7.2. Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.

5.7.3. Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, one full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

5.7.4. No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.

5.8. Piping materials shall be as follows:

5.8.1. Water Main and Service Lines: PVC, C900, Class 150 conforming to AWWA C-900 Standards for lines 4-inch diameter and larger and soft copper (Type K) for lines 2 inches in diameter or less. For connections 2" and under use a saddle tap. 4" and up use a Tee only. All piping larger than twelve (12) inches in diameter shall conform to AWWA c-905 Standards.

5.8.2. Water Distribution System Plans: The piping pressure class is 150 psi for water distribution. Cast iron fittings shall be class 250. Valves shall isolate lines at the intersection of all branch and main lines. Services shall have a curb stop box and a corporation stop. Mains shall be considered as that part of the water system supplying fire hydrants. Mains are to be valved so that no more than 2 hydrants will be out of service due to a single break in the water distribution system.

5.8.3. Ductile-Iron Pipe:

1. Thickness design shall conform to AWWA C150.
2. Manufacture shall conform to AWWA C151.
3. Thickness class, unless otherwise indicated or specified, shall be Class 52.
4. Pipe is to have an exterior bituminous enamel coating and a standard cement mortar

lining in accordance with AWWA C104.

5. All ductile iron pipe and fittings shall be wrapped with a 8 mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5 installation methods.
6. Use single rubber-gasket push-on joints or mechanical joints conforming to ANSI/AWWA C111/A21.11. Furnish with all necessary hardware and gaskets.
7. Bell-and-spigot pipe joints conforming to ANSI A21.6 or ANSI A21.8.
8. For bolted/restrained mechanical joint, use Class 53.
9. For unbolted/restrained mechanical joint, use Class 53.
10. Do not use drilled & tapped retainer glands.
11. Plain end of push-on pipe factory machined to a true circle and chamfered to facilitate fitting gasket.

5.8.4. Polyvinyl Chloride (PVC) Pipe:

1. Allowed for use in sizes 6 to 10 inch, except where noted otherwise in the specifications.
2. PVC pipe design shall conform to AWWA C900 and all pipe shall have the same outside dimensions as ductile-iron pipe.
3. Thickness class shall be DR 18 (Class 150).
4. PVC pipe materials shall not be used in any area where there is likelihood the pipe will be exposed to significant concentrations of pollutants comprised of lowmolecular-weight petroleum products or organic solvents or their vapors.
5. PVC water main shall be marked with tracer wire for the entire length to make electronic location possible.
 - a. The insulation shall be protected to prevent accidental grounding. Make few splices, and where necessary, splice the wire together using an approved wire connector.
 - b. The wire shall be installed continuously as the pipe is backfilled. The wire shall be fixed to the side of the pipe at a position of 2 o'clock or 10 o'clock and attached with duct tape every 5 feet.
 - c. Bring the wire to the ground surface at each fire hydrant and loop the wire in the hydrant valve with at least one foot of extra wire inside the box. If there is no fire hydrant within 500 feet, bring the wire to the surface in an inline valve box.
6. Where there is evidence there will be considerable underground construction or several large diameter service taps or connections, ductile iron pipe materials will be used.
7. Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used. PVC water main materials may not be deflected. PVC water main joint deflections shall be limited to manufacturer's recommendations.

5.8.5. Fittings:

1. All fittings shall conform to ANSI/AWWA C110/A21.10, with pressure rating of Class 350. All fittings must meet allowable lead in fittings standards ANSI/NSF 61, Annex G and (UNS copper alloy C89520 per ASTM B584-05 or copper alloy CDA No. C89833.

2. Mechanical Joint Restraints. Megalug, Mechanical Joint Restraints, or approved equal may be used at all mechanical joint fittings. Thrust blocks shall be required at all mechanical joint fittings, whether restrained joint fittings are used or not. Mechanical-joint

3. Ductile Iron Fittings. Ductile iron fittings shall be Class 350 SSB fittings conforming to AWWA C-153 Standards. Valve Boxes. Main line valve boxes shall be designed for slip or screw type adjustment. Valve boxes shall not be located in gutter flowlines or sidewalks.

5.8.6. Valves & Valve Boxes:

1. Gate Valves. Gate valves shall be Mueller Resilient Wedge Gate Valves, or an approved equal, conforming to AWWA C-509 Standards. Use full line size gate valves with epoxy coating inside and outside and with stainless steel nuts and bolts. Valve bodies shall be ductile iron or cast iron. Valves are to be non-rising stem with the stem, nut and thrust collar made of bronze. Use valves with at least 200 psi working pressure. The waterway must be a full sized waterway. Valves shall be capable of being repacked or replacing O-rings under pressure.

2. Butterfly Valves. Butterfly valves shall be Mueller Lineseal Butterfly Valves, or an approved equal, conforming to AWWA C-504 Standards. All valves over 12 inches in diameter shall be butterfly. Valve seat to be installed on disk or valve body. Valves shall be short body pattern with mechanical joint ends. Shaft seals shall be o-ring type. All interior and exterior cast iron, ductile iron or steel surfaces shall be painted with an epoxy coating and contain stainless steel bolts and nuts. Working pressure of the valve shall be at least 150 psi.

3. Valves shall open left and be furnished with a 2" square operating nut. Use Cor- Ten steel.

4. Valve Boxes shall be 2-piece or 3-piece slip type, range 51" to 71". Use lids marked "water".

5. Tapping valves shall be as specified for resilient-seated gate valves with the exception that one end shall be mechanical joint and the other end shall be flanged to match the tapping sleeve and shall have oversize seat rings to permit the entry of the tapping machine cutters. Valves shall be epoxy coated inside and out with stainless steel nuts and bolts. Valves shall be 175 psi minimum working pressure, mechanical joint.

5.8.7. Special Fittings:

1. Special pipe fittings must be approved by the Base Civil Engineer.

2. Special fittings must be the same diameter, thickness and pressure class as standard fittings.

3. Special fittings shall be manufactured to meet requirements of same specifications as standard fittings except for laying length and types of end connection.

4. Retaining spools may be used.

5. Full body tapping sleeves shall be mechanical joint, split construction with end Gaskets, manufactured to fit cast iron or ductile iron pipe. Branch shall have a flange fitting to match the tapping valve. Sleeve shall meet the OD requirements

for Class A, B, C, or D pit cast pipe and shall be furnished with all accessories. Bolts must be stainless steel and/or NSS Cor-Blue. Full body tapping sleeves are required for 12-inch and larger pipe or under paving.

6. Stainless steel tapping sleeves shall be epoxy coated with ductile-iron flange and stainless steel bolts and shall be compatible with approved tapping valves. Valves shall meet the OD requirements for Class A, B, C, or D pit cast pipe. Nitrile gaskets shall be used in L.U.S.T. areas.

7. Tapping sleeves for 12" or 16" shall be ductile iron or CASI. The outlet of the tap shall not be greater than ½ of the diameter of the pipe tapped.

5.8.8. Sleeve Type Couplings:

1. Bolted straight coupling shall be 6 bolt, 6" long, with stainless steel nuts and bolts.

5.8.9. Gaskets, Bolts, and Nuts:

1. Mechanical joints made with stainless steel bolt studs with stainless steel nut on each end.

2. All thread rod used to restrain fittings shall be stainless steel with stainless steel nuts and 3/4" diameter.

5.9 Location of Valves:

1. Four-way connections will have 4 valves. On looped systems, valves will generally be on the main line.
2. Three-way connections will have 3 valves. On looped systems, valves will generally be on the main line.
3. Maximum valves spacing will be 800 feet in residential areas or 400 feet in commercial areas. Maximum spacing of 400 feet will apply to mains bordering both residential and commercial areas.
4. Auxiliary valves shall be provided for all fire hydrants.
5. Valves shall be located as close as possible to tees and crosses.

5.10. Fire Hydrants: Fire hydrants shall be UL listed, dry barrel type, either Kennedy (Guardian) or Super Centurian (Mueller) conforming to AWWA C-502 standards. Install fire hydrants in accordance with UFC 3-600-01. Fire hydrant spacing is dictated by UFC 3-600-01 section 3-7.3.3. Preference is to install hydrants at intersections whenever possible. Hydrant laterals shall be 6-inch minimum size, shall not exceed 50 feet in length, and shall have an underground shut-off valve with an adjustable valve box in each lateral within 10 feet of the hydrant. Hydrants shall have their pumper outlet (4-1/2") facing the street. Hydrants shall be located a minimum of 3 feet and not more than 7 feet from pavement, and shall not be located in sidewalks or where obstructed by parked vehicles, shrubbery, etc. Flow test and mark each hydrant in accordance with base standards, fire flow color code sheet (reference UFC 3-600-01). See Appendix 9 for a typical fire hydrant detail.

5.11. Curb and Corporation Stops: Provide each building with a separate curb stop in the grassed area between the back of the curb and the beginning edge of the sidewalk.

Curb box shall be cast iron, Minneapolis pattern, and must be approved by the contracting officer. Corporation Valves and Service Valves. Corporation valves and service valves shall be Mueller 300 Series ball valves, or an approved equal. Corporation stops shall be double strapped with bronze saddles. Curb shall be bronze with Minneapolis top and copper flare connections. Pour a concrete collar at least 12" x 12" around the lid.

5.12. Bedding and Backfill:

A. All mains 12" and larger shall be bedded in crushed stone to a depth of one-half the pipe diameter.

B. All other pipe shall be bedded in accordance with Montana Public Works Standard Specification.

5.13. Performance and Testing:

A. Must meet the minimum requirements of Montana Public Works Standard Specifications.

B. Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C651. A minimum free residual chlorine concentration of 10mg/l shall be maintained for the 24-hour disinfection period. The contractor shall provide documentation of bacterial tests from a certified laboratory.

C. Pressure and leakage test in accordance with AWWA C600.

D. Valves shall be located and tested to verify operation.

E. Fire hydrants shall be tested to verify operation.

F. Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

5.14. Cathodic Protection: Provide cathodic protection for all material subject to corrosion used in the utility distribution system. All fire hydrants and all ferrous metal underground utility components, including piping, valves, connections, sleeves, etc., shall be protected by a cathodic protection system.

5.15. Flanged joints: Flanged joints are only allowed at the auxiliary valve to a hydrant or fire riser or for waterlines above ground or in a pit.

5.16. Tracer Wire: All plastic or PVC piping systems shall include warning tape and #12 TW tracer wire installed per standard drawing for the specific utility.

5.17. Waterline Taps: Water line tap shall be performed while line is under pressure or contractor shall process an outage notification 14 days prior to outage. For building water supply, connect to existing base distribution system to meet functional design requirements. Live taps can only be done for service lines that are 2 or more pipe sizes smaller than the line being tapped.

6.0 PLUMBING:

6.1. Design Standards: The system shall comply with the design requirements in:

- 2009 International Plumbing Code (IPC)
- UFC 3-420-01 – Plumbing Systems, with Changes 1-8

6.2. Interior Plumbing: Use rigid copper (Type L) or PEX.

6.3. Lead Regulations: All fittings must meet allowable lead in fittings standards ANSI/NSF 61, Annex G and (UNS copper alloy C89520 per ASTM B584-05 or copper alloy CDA No. C89833.

6.4. Double Wye Fittings: Use of double wye fitting placed horizontally is strictly prohibited.

6.5. Yard Hydrants: Provide freeze-proof yard hydrants on each side of the building, for grounds and maintenance.

6.6. Service Line: The fire protection line and the domestic water supply lines shall be two separate lines from the water distribution system.

6.7. Water Coolers: Provide refrigerated water coolers in corridors adjacent to toilet facilities.

6.8. Water Requirements: Provide hot water to lavatories and janitor closets and to support areas requiring hot water. Water heaters shall be natural gas types. Investigate the use of instantaneous hot water heating devices for domestic water systems. Provide life cycle cost data in the design analysis to substantiate cost savings. Hot water temperature at lavatories shall not exceed 120 degrees F. Specify shutoff valves for hot and cold water at each fixture.

6.9. Pipe Insulation

Pipe insulation shall be Owens-Corning Fiberglass 25 ASJ/SSL pipe insulation or equal. Wall thickness shall be as listed herein for each system and pipe size.

Hot service pipe to be covered with insulation in thicknesses as listed herein.

System/Pipe Size	1" & Under	1-1/4" – 1-1/2"	2" - 4"	5" - 6"	8" & Above
Domestic Hot Water	1"	1"	1"	1-1/2"	-
Recirc. Hot Water	1"	1"	1"	1-1/2"	-
Hot Water Heating	1"	1"	2"	2-1/2"	3"

Cold service pipe to be covered with insulation in thickness as listed herein.

System/Pipe Size	1" & Under	1-1/4" – 1-1/2"	2" - 4"	5" - 6"	8" & Above
Domestic Cold Water	1/2"	1/2"	1"	1-1/2"	2"
Chilled Water	1"	1"	1-1/2"	1-1/2"	2"

Exterior (Outdoor) Piping

Exterior piping shall be insulated with closed cell elastomeric foam rated for use from - 30°F to 220°F with a thermal conductivity not exceeding 0.27 Btu•In/Hr•FT²•°F (at 75°) and a water vapor transmission not exceeding 0.10. Insulation shall be fully adhered Armstrong Armaflex II or approved equal in the following thicknesses.

System/Pipe Size	1" & Under	1-1/4" - 2"	2-1/2" - 4"
All Systems	1"	1-1/2"	2"

7. FIRE PROTECTION

7.1. General: The A-E shall design the project in strict accordance with the requirements of UFC 3-600-01, (current edition), International Building Code (current edition) and, the National Fire Protection Association (NFPA) Latest Edition of the following:

- NFPA 10 Portable Fire Extinguishers
- NFPA 13 Installation of Sprinkler Systems
- NFPA 70 National Electrical Code
- NFPA 72 National Fire Alarm Code
- NFPA 90A Installation of Air Conditioning and Ventilation Systems
- NFPA 90B Installation of Warm Air Heating and AC Systems
- NFPA 101 Life Safety Code
- NFPA 170 Symbols for Architectural and Engineering Drawings

And Laboratory Publications:

- Underwriters Laboratories (UL)
- Factory Mutual Approval Guide
- National Electrical and Electronic Engineers
- Institute of Electrical and Electronic Engineers
- American National Standards Institute

7.2. Water Supply: Water supply for fire protection will be the base distribution system. Storage is adequate. Reference UFC 3-600-01 for fire hydrant colors. Hydrants shall be installed in accordance with UFC 3-600-01, current edition and testing in accordance with NFPA 291, and local requirements. Written certification of flushing and flow test of

the hydrants and sprinkler systems will be provided to the base plumbing and the base fire prevention office (341 CES/CEFP).

7.3. Fire Extinguishers: Facility construction will be in accordance with AFR 88-38. Facility fire extinguishers shall be provided for each construction project upon completion and be of size and rated as required by base requirements of 4A 60BC-10 lb. Type rated and fit extinguisher cabinets, size 8"x8"x28", full flat face glass in door, no locking hardware, extinguisher to sit on bottom of cabinet (no hanging brackets) and be of semi-recess or recess-type cabinet.

7.4. Fire Alarms: Most facilities require a fire alarm detection system. Requirements for these systems will be determined by the base fire prevention office as soon as the type of construction and occupancy type are determined. If a fire alarm detection system is required, addressable fire alarm panel and addressable detection devices shall be used. Alarm circuits shall be "Class A." Fire alarm pull stations will be installed at each exit to include mechanical rooms with minimum of two-pull stations per floor. Notification devices shall be audio-visual, horn/strobe type with adjustable dba taps and match the interior décor design of the facility. Otherwise, they shall be red in color. All fire alarm pull stations will be red with white lettering. The dba level of notification devices shall be not less than 100 dba. All fire alarm devices and panels shall meet Underwriters Laboratory (UL) requirements as listed in the UL Fire Protection Equipment Directory, Underwriters Laboratories dated 1998. All fire alarm, detection, and tamper switches shall be connected to the addressable fire alarm panel. The base fire prevention office will determine the number of zones required or approve zoning requirements before installation. All fire alarm system installation of any kind, NFPA Code 72, shall be used. The fire alarm contractor must ensure fire alarm components are compatible and cross-listed by UL for use with each other.

7.5. Licensing: Installation of fire alarm detection systems, fire protection suppression systems, and any of the components, the technician installing the equipment must be licensed in the state of Montana and hold the proper endorsement for such installation. The licensed and endorsements are as follows: SAF = Fire Alarms, SEF = Extinguishing Systems, and SAFS = Special Agent Fire Suppression Systems.

7.5.1. Installer Requirements: A licensed journeyman electrician can install fire alarm systems and its components if the above endorsements are stamped on their license and factory trained or NICET II certified and factory trained in the installation of the fire alarm devices being installed. The installer must be NICET II certified and licensed with the state of Montana licensing program to inspect, test and certify the operational condition of the system and make the connections to the system. All licenses, endorsements and NICET certifications must be presented to the contracting officers, the fire prevention office, and the company name and personnel names installing the system before work is to begin.

7.5.2. Code Requirements: All fire alarms, fire suppression, and special agent systems must be installed IAW the appropriate NFPA Code 13, 13A, 17, 17A, 24, 25, 72, 101

and any other reference mentioned in contract specification, recommendations, and construction drawings. Current licenses, endorsements, and NICET certifications must be on file with the Department of Commerce, Professional and Occupational Licensing Bureau, 11 North Jackson, PO Box 200513, Helena MT 59620-0513.

7.5.3. Warranty: All fire alarm and detection systems, fire suppression systems, special hazard fire detection and suppression systems will come with a five-year warranty and emergency recall service (respond within 45 minutes) for repair and service when notified.

7.6. Fire Suppression Systems: The entire facility shall have an automatic sprinkler fire suppression system. Sprinkler heads in corridors shall be flush mounted and inconspicuous. Each dormitory/apartment facility shall also have a Dry Class I standpipe installed on each floor in the enclosed stairway with a 2 1/2 inch (fire department stand thread) hose connection pointing up toward the direction of the next upper floor. Fire department connections for sprinkler and standpipe shall be mounted in the same location together (street side or parking lot side) on the facility and not separated at different location on the facility. Each connection shall be properly identified and marked IAW the proper NFPA code.

7.7. Review Authority: The Malmstrom AFB Fire Prevention Office must review and approve all fire alarm detection and sprinkler system designs proposed by the contractor before it is installed. A licensed fire protection engineer must certify all fire alarm and sprinkler designs before review and approval by the fire prevention office.

7.8. Addressable Fire Alarm Panels: Addressable fire alarm panel to be located at the front entryway of the facility accessible to fire alarm maintenance personnel and fire department personnel only. Fire alarm keys shall not be given to the facility manager; only to fire department and fire alarm maintenance personnel only. Other locations must be coordinated through the MAFB Fire Prevention Office. Fire alarm panels will not be installed or placed in mechanical rooms.

7.9. Smoke Detectors in Dorms: Dormitory smoke detectors are connected to the facility fire alarm system to indicate facility alarm activation when activated and if tampered with transmitting a fire alarm code to the fire department. Smoke detectors are not required in dormitory corridors if facility is entirely sprinklered. Smoke detectors are required in each dormitory/apartment sleeping room and connected to fire alarm panel as required herein.

7.10. Heat Detectors: Heat detectors shall not be used in facilities that are completely sprinklered. The sprinkler head serves as the heat detector. However, if used, fixed temperature electronic resettable types are to be used not rate of rise. All smoke detectors installed in living quarters-type facilities shall be Class A addressable and connected to the facility addressable fire alarm panel to indicate activation or tampering (dorm/apartment facilities only) and will activate the facility fire alarm system.

7.11. Special Fire Suppression System Requirements:

7.11.1. Means of Egress: Comply with NFPA Life Safety Code 101, current edition.

7.11.2. Fire Area Limitations: Comply with UFC 3-600-01, and Life Safety Code 101, current editions.

7.11.3. Firewalls, Partitions, and Draft Curtains: Comply with UFC 3-600-01, and Life Safety Code 101, current editions.

7.11.4. Emergency Lighting: Comply with Life Safety Code 101 current edition.

7.11.5. Finish Materials: Use of Class “C” interior finishes is not allowed. Public assembly facilities shall use all Class “A” interior finish materials. All other areas may use Class B interior finishes providing it meets the requirements of UFC 3-600-01, and Life Safety Code 101, current edition.

7.11.6. Post-Indicator Sprinkler and Outside Screws and Yoke Valves: Outside screw and yoke valves shall be used on sprinkler system and be provided tamper switches tied to the fire alarm system.

7.11.7. Lightning Protection: Provide lightning protection for designated buildings in accordance with NFPA 780, ETL 90-6 and AFI 32-1065.

7.11.8 Life Safety: All life safety features must comply with NFPA “Life Safety Code” 101, current edition and UFC 3-600 without exception.

7.11.9 Public Assembly: Public assembly facilities with occupant loads of 300 or more people shall be sprinkled. (Ref: LSC 101-current edition)

8.0 SANITARY SEWER:

8.1. Wastewater Treatment: Sewage treatment for the base is supplied by the city. New facilities shall connect to the nearest adequately sized sewer line. For projected wastewater discharge, the A-E shall determine the quantity of wastewater created and discharged by the facility. The new sewer lines will be designed to handle these requirements.

8.2. Sanitary Sewage System Design: Sanitary sewer systems shall be designed, constructed and tested in accordance with the current editions of:

- Montana Department of Environmental Quality - Circular 2 Design Standards for Wastewater Facilities
- Montana Public Works Standard Specifications.
- UFC 3-240-04A – Wastewater Collection
- UFC 3-240-06A – Wastewater Collection and Pumping

- UFC 3-240-07FA – Sanitary & Industrial Wastewater Collection: Gravity Sewers & Appurtenances
- UFC 3-240-08FA – Sanitary & Industrial Wastewater Collection: Pumping Stations and Force Mains
- AFM 88-11, Volume 1, Sanitary & Industrial Waste Water Collection, Gravity Sewers and Appurtenances.

Water and sanitary sewer system designs shall be reviewed by Montana Department of Environmental Quality for approval. Design calculations and testing results shall be submitted to the BCE as required or requested.

8.3. Sewer Location & Alignment Requirements: Location and alignment criteria are as follows:

1. General – There shall be a minimum horizontal clearance of 10 feet between parallel water, and sanitary sewer mains. A minimum horizontal clearance of 5 feet shall be maintained between sewer mains, parallel storm drains, and other utilities. On crossings, water lines shall be a minimum of 18 inches above the sewer line.
2. Lines in Drainage Swales – Sewer lines shall not be located within a drainage swale. The horizontal distance between the sewer line and the top of the bank shall be sufficient to maintain the integrity of the drainage swale and provide access for maintenance to the sewer line.
3. Alignment – Sewer lines and structures shall be designed to provide a minimum 12-inch vertical clearance from all utilities and/or improvements, unless otherwise approved by the government. Vertical alignment shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required.

8.4. Materials: All new sewage piping shall be PVC in accordance with ASTM-D-3034, type PSM, with a maximum SDR of 35, size 15 inches or less in diameter, with flexible elastomeric gasket joint in accordance with ASTM-D-3212. HDPE can be used during retrofitting of sewer lines if pipe bursting is used. If there are sags in the existing line pipe bursting will not be allowed. Other methods of sewerline repair will be considered on a case by case basis.

8.5. Minimum Pipe Size: Sewer lateral lines (connections from building sewer lines to main) shall be 4 inches minimum. Services greater than 100 feet in length shall be 6 inches in diameter. Clean-outs shall be provided according to applicable codes. The minimum size of the collection line (sewer main) shall be 8 inches.

8.6. Minimum Depth: The depths of sewers shall be in accordance with MDEQ Circular 2. MDEQ Circular 2, Paragraph 33.2 states, “In general, sewers should be sufficiently deep to receive wastewater from basements and to prevent freezing. Insulation shall be provided for sewers that cannot be placed at a depth sufficient to prevent freezing.”

8.7. Slope and Velocity :

1. Manning's formula shall be used to determine the relation of slope, design flow, velocity, diameter, and "n" value. The "n" value shall not be less than 0.013 for all pipe materials.
2. The maximum depth of flow at design conditions in any lateral 10 inches in diameter or less shall be 70 percent of pipe diameter. Lines 12 inches in diameter or larger may be designed to flow full unless direct sewer connections are planned, in which case the 70 percent pipe diameter maximum depth of flow shall govern.
3. All sanitary sewer pipe shall be designed for a minimum scour velocity of 2 feet per second at peak flows. The volume of wastewater within the pipe system as determined above shall be used when designing pipe slopes.
4. Maximum design velocity shall not exceed 10 feet per second.

8.8. Capacity: Pipe capacity, in all cases, shall be adequate to carry the Peak Wet Weather Flow (PWWF) from the entire tributary shed area even though said area may not be within the project boundaries.

8.9. Depth: Sewer mains with service lateral shall not exceed a depth of 15 feet. The system shall be designed to provide a minimum slope for sewer services of $\frac{1}{4}$ inch per foot with a minimum cover of 12 inches at any buildable location within the properties to be served. Proposed building pad elevations shall be a minimum six inches above the lowest upstream manhole rim. Where the building pad does not meet the elevation requirement, a backwater valve for the building shall be required. The backwater valve shall be noted on the improvement plans and building plans. Installation shall be made during construction of the underground improvements.

8.10 Storm Water: No storm water shall discharge to any sanitary sewer.

8.11. Manhole Criteria: The design criteria for manholes are as follows:

A. General – Manholes shall be placed at the intersection of all sanitary sewer lines, at the upstream end of a pipe run, and at the end of any temporary line more than 200 feet in length. No more than three lines may enter a manhole with one line exiting. Watertight manhole covers shall be required in all locations where flooding may occur. Manhole covers shall not be located in gutter flowlines, sidewalks, or within the wheel path of a vehicular travel lane.

B. Spacing – Maximum spacing of manholes shall be 500 feet for all straight lines of 10 inches in diameter or less. Manhole spacing for mains 12 inches and larger shall be considered on a case by case basis. A line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on curved lines

of 200-foot radius (minimum allowable) shall be 200 feet. Manhole spacing on curved lines of radii between 200 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. A manhole shall be required at any change in vertical alignment.

C. Invert Elevations – The invert elevation for pipe of the same diameter entering a manhole shall have a 0.10-foot drop between the entering and exiting pipe. Under special circumstances, the 0.10-foot drop may be waived with the approval of the

government. Invert elevations for pipe of different diameters shall match crown of exiting pipe. The crown of the entering pipe shall be at the same elevation or higher than the exit pipe.

D. Manhole Sizing – A standard 48 inch manhole with a 24 inch access opening shall be used for sewer mains 12 inches and smaller, and not exceeding 20 feet depth. A 60 inch manhole with a 36 inch opening shall be used for sewer trunk mains 15 inches to 36 inches in diameter. The design of larger trunk mains shall be approved on a case-by-case basis.

F. Manhole Access – Provisions must be made to prevent vegetation from overgrowing the manholes. An all weather 10-ton vehicular access shall be provided to each manhole as required by the government. Turning radii of 30 feet inside and 45 feet outside, and a vertical clearance of 14 feet are required.

8.12. Drop Connection Criteria: Drop connections shall be permitted under special conditions and with the approval of the government. There shall be no more than two inside drop connections into a 4-foot diameter manhole. If an elevation difference of at least 3 feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop.

8.13. Warning Tape for Force Mains: Detectable warning tape shall be a minimum of 5 mils thick, three inches wide and conform to APWA colors. Warning tape shall be buried 12"-24" below finished ground surface.

8.14. Tracer Wire for Force Mains: All force mains shall be laid with 12 gauge insulated solid core copper tracer wire. Tracer wire shall be insulated and taped to the top of the force main. Splices of tracer wire shall be made with heat shrink tape. All force mains burst through existing mains or installed without continuous trench access shall be installed with 1/4" steel tracer cable.

8.15. Design Analysis of Gravity Sewers: At the request of the government the design engineer shall submit a written report for all improvements or additions to the sanitary sewer system. The report shall assess the ability of the existing collection system to handle the peak design flow from the project and the impact on the Wastewater Lift Station.

8.16. Sewage Lift Station: A written report shall be submitted by the Design Engineer for any project that requires a new sewage lift station or will contribute inflow to an existing sewage lift station.

The report for the new sewage lift station shall contain, but not be limited to, the following:

- A description of the proposed wet well, pumping system and force main.
- The capacity of the recommended pumps and potential for upgrading.
- A map showing the potential lift station service area.
- The average and peak design flows for the proposed project and for the potential service area.
- The hydraulic capacity of the force main.

- The reserve capacity of the lift station when the proposed project is on line at full capacity.
- The pump run and cycle times for the average and peak design flows.
- Strategies for improvements which may be necessary to accommodate future sewer extensions, i.e., increased storage, pumping or auxiliary power capacity.
- A statement of the pump selection process, including the Engineer's calculations for the total dynamic head, total discharge head, net positive suction head and other pertinent pump selection criteria.
- The designed pump operating curve plotted on a manufacturer's pump performance chart with the designed operating point clearly identified.

The report for a project that will contribute inflow to an existing sewage lift station shall contain, but not be limited to, the following:

- A description of the existing wet well, pumping system and force main.
- The capacity of the existing pumps and potential for upgrading.
- A map showing the potential lift station service area.
- A list of the existing users and their average design flows.
- The existing peak design flow and reserve capacity.
- The pump run and cycle times for the existing average and peak design flows.
- The hydraulic capacity of the force main.
- A list of the proposed users and their average design flows.
- The proposed average and peak design flows to the lift station.
- The reserve capacity of the lift station with the proposed project on line at full capacity.
- The pump run and cycle times for the proposed average and peak design flows.
- Recommendations for improvements, if necessary to enable the lift station to serve the proposed project.
- An emergency backup power supply shall be required for all lift stations.
- One joint of ductile iron pipe, Class 50 cement lined, shall be installed on the influent pipe to the wet well. The spigot end shall extend into the wet well 6" beyond the interior wall of the wet well.
- The lift station shall be served by a 12-foot minimum width paved access way to provide access by sewer maintenance vehicles. The access way at the street shall have a concrete driveway paved between the curb and the sidewalk.
- An alarm system shall be provided that is capable of detecting power interruption, high water and high motor temperature conditions.

8.17. Oil/Water Separators: Automotive repair facilities and paint shops, dealerships, gas stations, equipment degreasing areas, and other facilities generating wastewater with oil and grease content are required to pretreat these wastes before discharging to the base sanitary sewer system. Pretreatment requires that an oil/water separator be installed and maintained on site. Oil/water separators for commercial/industrial processes must be sized on a case-by-case analysis of wastewater characteristics. Typically a minimum capacity of 750 gallons is required for small gas stations, auto repairs, and light commercial sites; 1,500-gallon capacity for large-scale truck washing and steam cleaning facilities. The ultimate discharge must be directed to the sanitary

sewer system. All units regardless of size shall be fitted with a standard final-stage sample box and spill-absorbent pillows. Oil/water separators shall be commercially manufactured and sized for the intended discharge rates for the facility where it is to be installed.

8.18. Bedding and Initial Backfill: Unless otherwise noted on the plans, bedding and initial backfill shall be per the Montana Public Works Specifications. Special backfill requirements shall be noted on the plans.

9. STORM WATER:

9.1. Stormwater: The base has four point source discharges off of the installation that enter a coulee named Whitmore Ravine which discharges into the Missouri River. Stormwater controls must be designed into every project to meet the requirements of the installations General Permit for Storm Water Discharge Associated with Small Municipal Separate Storm Sewer System (MS4). The current storm water system for the Airfield was designed to handle a 2 year 24 hr storm event. The rest of the installation was designed to handle a 10 year 24 hour storm event.

9.2. Stormwater System Design Standards: stormwater controls/systems shall be designed, constructed in accordance with the current editions of:

- Montana Department of Environmental Quality - Circular 2 Design Standards for Wastewater Facilities
- Montana Public Works Standard Specifications.
- UFC 3-210-10 Low Impact Development
- UFC 3-230-17FA Drainage In Areas Other Than Airfields
- DoD policy on EISA 2007 Section 438 signed by DUSD(I&E) on 19 Jan 2010. Further clarification on this policy is that the DoD defines 'predevelopment hydrology' as 'pre-project hydrologic' conditions.
- AFM 88-5, CHAP. 3 Technical Manual – Drainage & Erosion-Control structures for Airfields and Heliports
- Malmstrom's MS4 Permit

9.3. Design Philosophies: The peak rate of stormwater runoff from any proposed land development to any natural or constructed point of discharge downstream shall not exceed the pre-development peak rate of runoff.

When site conditions allow, infiltration is the preferred method of flow control for urban runoff. All projects are encouraged to infiltrate stormwater runoff on site to the greatest extent possible if such infiltration will not have adverse impacts on down- gradient utilities, foundations, roadways, and parking lots.

9.3 Permit Requirements: A MDEQ General Permit for Storm Water Discharges Associated with Construction Activity is required for any project that affects an area 1 acre or larger.

9.4. Design Precipitation for Conveyance system/structures: The design storm used at Malmstrom AFB is a 10 year 24 hour storm. Use local data for storm durations and intensities.

9.5 Basic Design Criteria for Control Methods:

Infiltration Facilities: Infiltration facilities shall be sized to fully infiltrate the post-development 10-year 24-hr design storm and the design water surface for all facilities shall be the 100-year post developed water surface elevation. All overflows (structure or spillway) shall pass the 100-year 24-hr developed peak flow rate. The overflow path shall drain toward the natural discharge point of the contributing basin, such that the overflow route or termination of stormwater does not adversely impact down-gradient properties or structures.

Retention Facilities: For projects proposing Retention, the facilities shall be designed to store the 100-year 24-hr post development storm events and shall provide an overflow path, wherever possible, with the capacity to convey the 100-year storm event.

Detention Facilities: For projects proposing to detain and release stormwater runoff, the facilities shall be designed such that the release rate does not exceed the pre-developed conditions for a range of storm events. The analysis of multiple design storms is needed to control and attenuate both low and high flow storm events. The NRCS Type 1 24-hour storm events is the design storm to be used for all flow control facilities that use a surface discharge. The design water surface for all facilities shall be the 100-year post developed water surface elevation. All overflows (structure or spillway) shall be located above the design water surface elevation and pass the 100-year 24-hr developed peak flow rate.

The total post-developed discharge rate leaving the site shall be limited to the pre-development rates listed in Table 9-1. Bypass flow shall be discharge at the pre-developed flow rate.

Table 9-1 Allowable Discharge Rates	
Design Frequency (24-hour Storm)	Post-Development Discharge Rate ¹
2-year	≤50% of 2-year 24-hr developed
10-year	≤10-year 24-hr pre-developed
100 year ² (Emergency Overflow)	Overflow Route Only ²

1. Post-developed flow is equal to the release from detention facility plus the bypass flow

2. The emergency overflow shall direct the 100-year post-developed flow safely toward the downstream conveyance system.

9.6. Existing Site Drainage: The A-E shall identify existing site drainage and provide collection system data to determine flow requirements. Verify adequacy of system. Upgrade and extend on-site drain system to existing base system to meet design requirements of the new facility.

9.7. Roof Leader Collection System: Provide rain water collection system for entire roof area and connect downspouts directly to new storm drainage system. Install heating cables with GFI protected thermostatic controls in gutters and downspouts.

9.8. Foundation Drains: Investigate the need for a foundation drain system and provide if design conditions dictate. Foundation drains need to be connected to storm drain system.

9.9. Grading and Drainage: Provide storm drainage in accordance with AFM 88-5, Chapter 4, Drainage for Areas Other Than Airfields. Storm drainage shall be designed using the 10-year 24-hour storm frequency. Rainfall intensity shall be based on US Department of Commerce Weather Bureau data.

9.10. Surface Storm Drainage: Provide drainage away from all buildings on all sides with a minimum slope of 8 inches in 10 feet, for a minimum of 30 feet.

9.11. Minimum Size: Storm drains and main culverts shall have a minimum diameter of 15 inches. Lines from a field inlet or curb and gutter inlet to a manhole, minimum size is 12 inches.

9.12. Pipe Materials: Storm drainage material shall be PVC or RCP.

10.0 LANDSCAPING

10.1. Lawn Sprinkler System: All landscaped areas shall be irrigated by an underground sprinkler system with automatic controls and connected to base's irrigation management control system (IMCS) main computer located in building 470. Irrigation systems are to be water saving and state of the art. System requires gravity drain for freeze protection. Provide drip irrigation system for landscaping. Add air hose connection to irrigation piping for winter maintenance/system evacuation. Installation of irrigation is required in high visibility areas such as along Goddard Avenue and around Bldg 500. Backflow prevention is required on all irrigation systems. The base preference is to use polyethylene pipe(PE) for irrigation systems. The use of PVC in irrigation systems should be limited to areas in which the operating pressures are too great for PE pipe. Sleeve all irrigation lines that run under roadways, driveways, etc.

10.2.. Landscape Design: The A-E shall also provide comprehensive landscape design services. The design objective is to provide an exterior environment which will integrate design (architectural and landscape) of the adjacent facilities located near the site. The species provided in this supplement are either native to Montana or are considered ornamental (non-invasive) and able to survive in USDA Hardiness Zone 4 or colder.

Species not included in this supplement may be planted with written consent from the 341 Civil Engineer Squadron/Conservation Program. For additional Information See Appendix 8 – Landscape Planting Pallet.

10.4. Xeriscape: Xeriscape principles should be used in areas of the base that are not highly visible, to include areas that are not along any DV routes. The preferred ground cover in Xeriscape areas is washed river rock and draught resistant plantings.

10.5. Seeding and Sodding: For all seeding and sodding requirements use specification 32-92-12 – Seeding, Sodding and Fertilizing located in appendix 7 as part of the landscaping planting pallet.

11. ELECTRICAL DESIGN

11.1. Existing High Voltage Primary: 12470/7200V 3ph 4 wire Y

11.1.1. Standardized HV circuit construction:

- #2 (on 200A Load break Elbows) or 500MCM (On 600A Dead Break Elbows) Cu 15KV BICC GENERAL Cables, Unishield, 133% EPR, ONLY
- Full size neutral, 600V conductor
- High Voltage underground in Concrete Ductbank with Carlon DB60 PVC conduit.
- Depth of concrete ductbank cover: 30" minimum.
- HV marking tape at 12" below grade.
- Aerial Conductor: Overhead conductor, 15KV shall be 4/0 Cu (Main Feeder) or #2 Awg Cu (Taps), annealed, Class B stranding.
- 4000 PSI concrete ductbank dyed red

11.1.2. Switch Gear:

- Padmounted
- Dead Front Construction
- 600A Dead break elbows on 500 MCM conductors, 200 A Load Break elbows on #2 110A conductors
- Exterior operated load break switching.
- Lexan Windows for viewing switching.
- Exterior color dark brown baked-on enamel
- Install a ground ring around switchgear pad with 4 each 10 foot cu ground rods connected with 3/0 AWG bare cu wire.
- Load Break 600 amp switches with arc-horn or arc-blade with extinguishing arc chute, only. Other arc extinguishing devices are unacceptable. Charged-air type arc extinguishing devices are not allowed.
- Exterior color shall be Dark Brown Fed Spec #37056 baked-on enamel

11.1.3. Transformers:

- 3 phase Pad mounted, commercial applications
- 1 phase Pad mounted, residential applications
- Dead Front Construction

- 12470/7200 VAC Y Connected Primary (Commercial), 7200V Primary (Residential)
- 95 KV BIL minimum
- 2 each 2-1/2 % taps above nominal and 2 each 2-1/2% taps below nominal
- maximum 65 degree C rise
- Oil drain, filler and level plugs w/ automatic pressure relief device
- Barrired high and low voltage compartments
- Over Voltage MOV Lightning arrestors
- Drywell CLE fuses at 150%
- High Voltage Loadbreak elbow bushings with bushing wells
- Loop Feed (feed thru) Feature
- Copper Windings
- 4 hole blade secondary bushings
- Pad-lockable door operating handle with pentahead security bolt.
- Exterior color shall be Dark Brown Fed Spec #37056 baked-on enamel
- Stencil KVA on exterior of transformer in 3" high, contrasting color.
- Install a ground ring around transformer pad with 4 cu ground rods connected with 3/0 AWG cu wire.
- Provide with external kilowatt-hour demand meter with necessary CT's and wiring connections (See Meter requirements in this publication)
- Transformers shall be screened-in with same architectural treatment as building.

11.2. SECONDARY SERVICE

600 volt copper cable in Schedule 40 PVC conduit in sand bed sized as required for the service to the facility.

11.2.1. Meters

General Electric KV Meter, Fitzall, Form 9S, 120v, 4 wire Y connected, 3 phase, 13 jaw, Class 20, factory programmed, electronic demand register and kilowatt-hour Digital display or approved equal. Approved equals must be provided with programming cable and software to set display, CT ratio and PT ratio. Pulse output module installed for connection to Basewide Energy Management and Control System.

Self contained Demand Meter (KW and KWh)

- Factory assembled and tested to exclude dust, clear lexan cover.
- LCD display, 6 digits
- Optical Communication Port on front cover for programming CT ratios and PT ratios and setting digital display.
- ANSI standard S form base.
- Contractor shall provide appropriate Current Transformers (CTs) and Potential Transformers (PTs) in appropriate enclosures for the size of the electric service, to provide a complete and functioning metering system.

11.2.2. Panelboards:

- Dead front safety type branch panelboards
- Anti-burn solderless pressure type lug connectors approved for copper conductors
- Copper bus bars
- Full size neutral bar
 - Heavy duty bolt on, quick make, quick break circuit breakers with toggle handles that indicated when tripped (Commercial Applications)
 - Snap in, quick make, quick break circuit breakers with toggle handles that indicate when tripped (Residential Applications)
- Engraved phenolic label on the exterior door
- Circuit-directory located inside door
- Rated for the Available Short Circuit Current and the Demand Current present
- Minimum 150A for Residential applications.

11.2.3. Conductors:

- All copper, aluminum is not acceptable.
- Run in conduit (EMT or Rigid Steel for commercial and Dormitories).
- Nonmetallic sheathed cable in single dwelling houses only.
- Minimum size: #14 AWG

11.3. Lighting:

- Use High efficiency electronic ballasted fluorescent fixtures where applicable.
- Lighting levels shall be in accordance with IES standards.
- Provide lights by all exterior doors.
- At least one emergency light per room.
- For recessed fluorescent fixtures provide back-up emergency ballast.
- All electrical components shall be UL approved and an integral component of the fixture.
- All ballasts for exterior lighting shall be the component type capable of providing lamp starting down -20 degrees F, with a power factor of 90% or better (high power factor). Ballasts shall be specified for a low watts loss of less than 10%.

11.4: Parking Lot Lighting:

Round, 30' non tapered, dark bronze **anodized** (powder coating is not acceptable) aluminum pole on circular concrete base. Shoe box type fixture, dark bronze anodized Type 5, Cutoff Distribution.

- 250 W HPS, 240 VAC Ballast
- Parking (Centered-Located)/Area Security: Kim Model 5SQ or approval equal
- Parking (Edge-Located): Kim Model EKG501 or approved equal
- The photometrics shall be such that foot-candle levels achieved will meet or exceed that achieved by the fixtures shown above, and be in accordance with AASHTO and IES recommended maintained illuminance design levels with

appropriate uniformity ratios of the roadway and area classifications indicated above.

- Photometric tests shall be performed and results provided by an independent testing laboratory.
- Where lighting is provided for any of the systems above, design and installation shall be on a "system" basis, not just on a fixture basis.
- All lighting shall be high pressure sodium unless there is a specific requirement for metal halide-type lighting.
- Each fixture shall have its own photo cell if not controlled by a contactor.
- Ballasts shall be multi-tap for operating at 120, 208, 240 and 277 volts.
- Each fixture shall be fused at the base of the pole.
- Lenses shall be heat-resistant, borosilicate glass, prismatic refractors. Retain each refractor in a frame. Restrain the frame to the luminaire housing by hinges or chain.
- Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- Materials shall be rustproof.
- Latches and fittings shall be non-ferrous metal.
- Poles shall be KIM cat.# PSA30-6188A/DB-A or approved equal.
- Poles and brackets shall be rated to withstand winds up to 100 mph, with vibration dampers to control harmonics from 20 mph sustained winds.
- Light and pole shall be grounded to a ground rod at the pole.
- Light base shall be concrete, 24" diameter,
- The light distribution type shall be:

Parking (Centered-Located)/Area Security:	Type 5
Parking (Edge-Located):	Type 3
- There shall be a handhole at the bottom area of the pole for access to connections, ground connections, and fusing.
- Pole finishes and color shall match the fixture and both shall be supplied by one manufacturer.

11.5. Major Collector Street Lighting:

Round, 39' tapered, dark bronze **anodized** (powder coating is not acceptable) aluminum pole on circular concrete base.

Collector/Major Roadway: Holophane Vector fixture, dark bronze anodized

Non-Collector Roadway: Kim Model EKG501 or approved equal

- 400 W HPS, Ballast shall be multi-tapping for operating at 120, 208, 240, or 277 volts.
- Luminaires shall be Holophane Vector 400 W HPS for major collector roads.
- Lenses shall be heat-resistant, borosilicate glass, prismatic refractors. Retain each refractor in a frame. Restrain the frame to the luminaire housing by hinges or chain.
- The photometrics shall be such that foot-candle levels achieved will meet or exceed that achieved by the fixtures shown above, and be in accordance with

AASHTO and IES recommended maintained illuminance design levels with appropriate uniformity ratios of the roadway and area classifications indicated above.

- Photometric tests shall be performed and results provided by an independent testing laboratory.
- Where lighting is provided for any of the systems above, design and installation shall be on a "system" basis, not just on a fixture basis.
- All lighting shall be high pressure sodium unless there is a specific requirement for metal halide-type lighting.
- Lamp wattage shall be 250 or 400 watt.
- Each fixture shall have its own photo cell if not controlled by a contactor.
- Each fixture shall be fused at the base of the pole.
- Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- Materials shall be rustproof.
- Latches and fittings shall be non-ferrous metal.
- Poles and brackets shall be rated to withstand winds up to 100 mph, with vibration dampers to control harmonics from 20 mph sustained winds.
- Light and pole shall be grounded to a ground rod at the pole.
- The light distribution type shall be:

Collector/Major Roadway:	Offset
Non-Collector Roadway:	Type 3
- There shall be a handhole at the bottom area of the pole for access to connections, ground connections, and fusing.
- Pole finishes and color shall match the fixture and both shall be supplied by one manufacturer.
- All poles, except poles for the Vector, Offset fixtures, shall be 30 ft in height. Poles for the Vector shall be 39 ft in height.

11.6. Ballasts:

- High Intensity Discharge (H.I.D.) ballasts
- Constant wattage, self-regulating type designed to operate the discharge lamp of the type and wattage shown on the drawings.
- Outdoor ballasts to be low temperature type, -20 F min., starting temperature.
- Locate protective devices for ballasts to be accessible if the devices are not integral with the ballasts.
- Ballasts shall be multi-tap for operating at 120, 208, 240, and 277 volts.

11.7. Concrete Bases:

- Foundations for the poles shall be reinforced concrete and be 24 inches in diameter.
- Foundations shall extend 6 feet below grade.
- Near roadways, driveways, in parking lots, and near curb edges, the foundations shall extend 3 feet above grade.

- In grassed areas not near asphalted areas, the foundation shall extend one foot above grade.
- At the intersection of the pole and the foundation, the area shall be grouted with a non-shrink grout after the pole is leveled and set.
- From one foot below grade to the top of concrete above grade, sonaform tubing shall be used as the form in pouring the concrete. After the stripping of the form, sack the exterior to fill all voids.
- A ¾" x 10' copper-clad steel ground rod shall be driven below grade adjacent to the pole foundation for grounding of the fixture and the pole. The grounding conductor shall be exothermically connected to the ground rod and installed in PVC pipe installed in the concrete foundation to the area of access handhole in the base of the pole.
- A pole and foundation detail shall be included in the project drawings.
- Sack-finish and round all edges to approximately 1/4" radius concrete surfaces above grade.
- Concrete to have 3000 psi minimum 28 day compressive strength.
- Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings and meet ACI 318M. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- Apply non-shrink grout between pole base and concrete foundation with a weep opening to allow moisture to escape. Refer to manufacturers recommendations.

11.8. Ground Level Hand Hole Splice Boxes:

- Splice boxes shall be concrete reinforced fiberglass composite (Associated Plastics Inc. or approved equal). Strengths shall meet or exceed 10,000 lbs. Plastic boxes are not acceptable.
- The splice box or compartment shall be a typical 15" x 28" x 15" tapered, stainless steel hardware, and with a flanged base to prevent tilting and frost heave.
- Covers shall be bolted down only, stainless steel hardware, OEM molded labeling, appropriately marked for the utility.

11.9. Engine Heater Plug-ins:

- Provide 120V AC receptacles for engine heater plug-ins in parking lot used for overnight parking. Each duplex receptacle shall be capable of supplying 1400 Watts. Receptacles shall be GFCI type.

11.10. Cathodic Protection:

Provide cathodic protection for all underground metallic structures. Provide necessary magnesium anodes, DC rectifier, and connections to metallic structures being protected. Provide for complete cathodic protection of underground metallic piping and structures in accordance with Mil HDBK 1136 & AFH 32-1290 and as follows:

11.10.1 Provide ground test well, flush with ground. Two per site.

11.10.2. Apply cathodic protection on all buried or submerged ferrous piping, tanks, and related facilities. Under no circumstances will coated facilities be installed without cathodic protection. This requirement includes ferrous metals such as cast iron.

11.10.3. All buried and submerged cast iron pipe joints will be bonded with Number 4 AWG insulated wire. Thermite wire connections must be coated.

11.10.4. All cathodic protection designs must be based upon specific field tests made at the construction site. Tests should include soil resistivity and water conductivity. Resistivity surveys to be provided to Base Civil Engineer with review packages.

11.10.5. The cathodic protection design must be based on providing a protection potential to meet the requirements of NACE Standard RP-01-69 (revised). These specifications must not be a performance-type, which requires the contractor to provide the design for approval, via submittal. The A-E will not be required to use a NACE accredited specialist.

11.11 Road Bores: Cutting, trenching roadways is not acceptable for installing utilities.

11.12. Lightning Protection:

Provide lightning protection for facilities with explosives, or expensive computer equipment.

Facilities with explosives shall have catenary or mast type lightning protection.

Lightning protection shall be designed in accordance with NFPA 780, and AFI 32-1065.

Provide bare copper grounding counterpoise around perimeter of building.

Use all thermo welded connections, bolted connections are not acceptable.

Use only approved lightning protection equipment (UL listed for lightning protection)

Only copper materials are acceptable.

Provide access to each ground rod with a ground box and removable lid.

Provide access to all connections.

11.13. Hand Hole Junction Boxes:

Communication and Hand Hole boxes shall be made of concrete polymer including the lid, with a minimum 10,000 lb wheel load. The lid shall have the appropriate label for the application permanently formed into the lid by the manufacturer.

12.0. FIRE ALARM/MASS NOTIFICATION SYSTEM REQUIREMENTS 24 FEB 12

12.1 Fire Alarm Control Panel:

To operate as part of a zoned, addressable, microprocessor-based fire detection and alarm system.

Shall contain an on-board 4 x 20 character, back lighted, LCD display.

Shall contain four (4) on-board initiating device circuits (SLC's) that are capable of being programmed as either four (4) Class B (Style 4) circuits or two (2) Class A (Style 6) circuits, with each capable of handling 99 detectors and 99 modules.

Shall contain an on-board 1000 event history log (with time and date stamped entries) stored in non-volatile memory.

Shall contain one (1) on-board industry standard RS-232 serial port, utilizing a 9 pin, type D female connector for programming and servicing the panel via the user's laptop computer. This port is to operate at a baud rate of 9600 bps.

Shall contain four (4) on-board, notification appliance / releasing circuits capable of being programmed for use as either four (4) Class B (Style Y) or two (2) Class A (Style Z) circuits. Shall contain programmable cross-zoning functions, day/night mode, and selective control operations.

Shall contain four (4) on-board, programmable function relays; Type Form C – 2.0A @ 30 VDC and two (2) onboard, auxiliary power outputs, 500 mA @ 24VDC each.

Shall contain eight (8) on-board, operator keys labeled as "System Controls." Each key shall have two LEDs associated with it to provide their function status. Three (3) keys shall be pre-assigned the following operations: "Acknowledge, Signal Silence, and System Reset." The remaining five (5) keys shall be user assignable.

Shall contain one (1) on-board, 4.3A power supply with an integral battery charger providing 2.5A for notification appliance circuits and auxiliary power outputs.

All input circuit and special features shall be programmable utilizing an external Windows based PC and "Network Plus" version 20.0 or higher software. All system parameters, the control panel display and operation functions shall be programmable utilizing the LCD (described previously) and an on-board fully functional keypad.

The FACP installer/programmer shall not deviate from the equipment manufacturers default settings unless such changes have been previously approved by the MAFB AHJ and Alarm System Maintenance personnel.

Note: The term "*on-board*" as used in this section is defined as the following; all fire alarm control panel capabilities as listed above shall be "standard equipment" and therefore shall in no way be considered optional! Therefore, it is totally unacceptable to add expansion cards or additional components as a means to meet these "on-board" control panel requirements.

12.2 Mass Notification System:

All mass notification system components shall be totally independent of the fire alarm system. The control panel for voice notification, shall also be totally independent of the fire alarm system control panel (not combined into one panel) and capable of

autonomous operation. Each system shall have its own independent power supply and batteries.

The mass notification system shall also utilize its own strobes and speakers independent of the fire alarm system.

Exception: An interface connection between the building's fire alarm system and its mass notification system is permitted as required by UFC 4-021-01.

12.3 Fire system, other:

All SLC's and NAC circuits shall be Class A (Style 6/Style Z). No isolation modules/bases are permitted.

Each SLC or NAC installed in the system, shall be run in a continuous loop (point to point), leaving the panel location in one conduit and retuning in another. For convenience the conduit system may include gutters or J-boxes, however no splices will be permitted within them, but shall only be permitted at device termination points. All device addresses, as indicated on the drawings, must reflect the exact order in which they are physically connected. Any exception to this requirement must be approved by the base AHJ and Alarm System Maintenance personnel.

All pull stations shall be single action, metal construction (no plastic), have no glass or plastic break rod and provide a key reset, unless an alternative product type has been specifically approved by the base AHJ. **Exception:** In facilities where young children are the primary occupants (such as a child care center), double action pull stations may be used without special approval.

All fire alarm system beacons shall be polarized and have a 24VDC rating, unless approval for an alternate product is obtained from the MAFB AHJ and CES Alarm System Maintenance personnel.

Photoelectric smoke detectors shall be used in all locations requiring life safety devices.

Only high temperature, fixed temp, heat detectors (165 deg F. or higher) shall be installed in mechanical rooms or other such areas, where due to higher ambient temperatures a more common 135 deg F. detector would not be practical. **Exception:** should the FACP be located in the same space, a photoelectric smoke detector shall also be installed above the fire alarm control panel (per NFPA 72).

All auxiliary power supplies and/or NAC power extender panels shall be supervised by the facilities FACP and shall report all abnormal conditions as a system trouble.

Any fire alarm (regardless of the initiating device) shall cause the shutdown of all air handling equipment in the building. **Note:** an exception to this requirement may be obtained from the MAFB AHJ, should any critical components exist in the facility that would be negatively impacted by such a shutdown.

All flow, pressure, and sprinkler valve tamper switch(s) (including PIV) shall be independently monitored using an "intelligent monitor module" w/integral LED, and mounted in a 4" sq, 2 1/8" (minimum) deep, metal junction box. With the exception of PIV modules, all modules shall be located within 4 feet of the device they are monitoring, unless a waiver of this requirement has been specifically granted by the AHJ or their designated representative.

The final location of all monitor and/or control modules shall be indicated on the As-built drawings. In addition, if any of these devices are not readily visible, at their installed location, a manufacturers label or permanent placard, using red letters on a white background, must be installed as near as possible to each device. These labels/placards shall be located in a readily visible location as near as possible to the device they are describing. As a minimum, this label/placard must indicate the devices purpose and its system address.

Electrical water gongs when used shall be on their own NAC circuit.

Minimum NICET Level II Certification is required for system installer/programmer.

Initiating device addresses (for all smokes, heats, pulls, etc.) shall be indicated directly on the plans and drawings and shall completely match the FACP's programmed database.

As specified below, automatically route all alarm, supervisory, and panel/system troubles to the base central station (BDOC) via radio transmission equipment only, utilizing a Monaco Enterprises Inc. BT2-8 transceiver.

12.4. Operation:

12.4.1: Required Fire Alarm & Mass Notification System Outputs when applicable: (Signals to Central Station)

1. General Alarm: Includes any initiating device activation (smoke, heat, pull, duct, etc.) Exception: water flow or supervisory devices.

For multi-story buildings, each level shall report separately, via the fire alarm control panel/relay module, to the transceiver in order to identify from which floor the alarm originated.

2. Water Flow activation
3. Duct detector activation
4. PIV/Valve Tamper (for all valve tamper switches, including PIV.)
5. Low Air Alarm (for dry systems only)
6. Panel/System Trouble (for Fire Control Panel or system troubles - such as open circuits, short circuits, ground faults, AC power failures, battery faults, etc.)

7. Mass Notification System Activated
8. Mass Notification Panel/System Trouble
9. Fire Pump Running
10. Fire Pump Trouble

12.4.2. Fire Alarm System Wiring: Use only red (outer sheath), listed, solid copper, two conductor (twisted pair or shielded), PLFA cable, minimum 18 AWG, using red (positive) & black (negative) conductors, for all SLC's.

Only individual, solid copper conductors (no cable assemblies) appropriately sized for the load, with distinguishing color pairs for each NAC installed in the system, shall be permitted.

All single conductor or multi wire cable assemblies located underground, for PIV switch monitoring, shall be listed for wet locations. Note: For PIV circuits only, individual conductors rated for wet locations are permitted to be used between the PIV's associated monitor module (normally located at the point of exit from the building) and its tamper switch.

12.4.3. Raceways & boxes: All newly installed fire alarm system circuits, where exposed or accessible (Example: surface mounted and/or above drop ceilings), shall be enclosed in **red** EMT. **Exception:** Any conduit fitting (connector, coupling, strap etc.) or any EMT raceway installed within walls or similar structures do not need to be red in color.

Note: Different raceway systems may be used when EMT is specifically not permitted or other types are required by NFPA 70 and/or other applicable building codes.

All covers, for junction boxes containing SLC and/or NAC wiring, shall be painted **red** on both sides.

Power: A single 120VAC branch circuit shall provide power to the FACP and BT2-8 Transceiver, be dedicated, marked for that purpose and have surge protection installed on its "LINE" side.

In addition, all NAC Power Extender panels installed in the facility, shall have surge protection on their "LINE" side.

Any FACP, Transceiver, NAC power extender(s) or Power supply utilized in the fire detection system, shall include their own backup batteries with an expected life of no less than 5 yrs. They shall also have an amp-hour capacity sized to sustain a minimum of 24 hours of normal system operation, in addition to 15 minutes alarm mode operation.

12.4.4. Software: The government (Civil Engineering Alarm Maintenance Shop) shall receive one certified manufacturer's copy (original - not a field copy) of the programming software used to create the FACP's database, a copy of the installed database, and all manuals covering the installation, operation and programming of the completed fire alarm system. The software shall allow the Government to add or remove any device to/from the system while maintaining its proper operation. The software shall be based on and operate under Microsoft's, Windows XP (32-bit) or Windows Vista (32-bit) or Windows 7 (32-bit) operating system. Along with the programming software the Government shall receive all required licensing and full rights for its use.

The contractor shall provide all necessary equipment and devices required to fully utilize the programming software, including but not limited to the following: interface cable for connecting the FACP to a laptop computer (RS-232 compatible), hardware/software keys, passwords required for full access of the programming software and complete operation of the fire alarm control panel.

12.4.5. Download/Upload: The FACP shall have the built in capability to download/upload its fire alarm system database, via a laptop computer, directly to/from one or more of the following: Hard drive, 3.5" floppy disk, CD, USB flash drive or other suitable media that has been pre-approved by CES Alarm Maintenance Personnel.

12.4.6: Transceiver: All fire alarm system installations shall include a new Monaco BT2-8 FSK encoded narrowband transceiver, compatible with the base fire reporting system (Monaco D-21). This unit shall include all parts necessary to send a minimum of 16 distinct signals (information about a building's fire system status) to the Central Station (Fire Department).

At no additional expense to the Government and at the discretion of CES Alarm Maintenance and the base AHJ, the contractor shall provide up to 16 separate outputs from the FACP or Addressable relays to the transceiver.

The transceiver shall be located within 10 ft of the main FACP and all addressable relays used to provide additional transceiver inputs.

CES Alarm Maintenance personnel shall be responsible for programming of the transceiver and D-21 system.

12.4.7. Antenna installation: Shall use only mini RG-8 coaxial cable completely enclosed in EMT conduit for its entire length.

A Nema 3R Enclosure shall be installed as part of the antenna assembly and shall be located on the exterior of the building away from all obstructions per the manufacturer's recommendations. This enclosure shall contain a lightning arrestor

attached to a newly installed ground rod (5/8" x 8' minimum) located directly below it. The arrester shall also be bonded to the building's power system ground per NFPA 70.

The antenna whip shall be cut to a length of 52-1/2" for compatibility with MAFB's fire reporting frequency. The antenna shall be installed to extend above the roof line and supported per the manufacturer's recommendations.

12.4.8. Transceiver zone wire: Conductors used to interconnect the fire control panel/ addressable control relay outputs to the transceivers inputs shall be a minimum of #20 AWG or a maximum #16 AWG solid copper. PLFA cable is permitted to be used for this purpose.

12.4.9. Operation Manuals: The contractor shall provide all Installation, Programming, and Operation Manuals relevant to the fire alarm system. The Government shall be provided a complete system wiring diagram indicating equipment terminal descriptions and the address of each installed device.

12.3.10. Labeling/Marking: All system field devices (Smokes, Heats, Ducts, Pulls, Modules, etc.) shall be labeled indicating their system address as reported by the FACP and their use or purpose, when not visually evident, using a manufactures labeling machine (not hand written). Only labels with Red lettering on a white background shall be used.

12.5. Training: A minimum of 8 hrs of FACP/System training shall be provided by the installer or system equipment manufacturer. Any additional training, required by the installer or equipment manufacturer and needed to permit the use of programming software or hardware, shall also be provided and paid for by them. This training shall be provided for up to 10 government personnel.

13.0 MECHANICAL:

13.1 MECHANICAL INSTALLATION DESIGN GUIDELINES AND STANDARDS: Design shall also conform to the base unique mechanical design requirements listed herein and current ETLs and CTLs.

- a. Air Force Design Manuals (AFM), Joint Service Manuals (AFJM), Regulations (AFR), Pamphlets (AFP) and Hand Books (AFH).
 - AFJM 32-1070 Plumbing
 - AFR 88-28 High Temperature Hot Water Systems
 - AFH 32-1163 Engineering Weather Data, July 2000
 - AFP 91-39 Heating, Ventilating and Air Conditioning Control Systems

- b. Air Force Engineering Technical Letters (ETL)
 - 83-7 Plumbing, AFM 88-8, Chapter 4,
 - 83-9 Insulation
 - 84-7 MCP Energy Conservation Investment Program (ECIP)
 - 87-1 Lead Ban Requirements of Drinking Water
 - 88-4 Reliability and Maintainability (R&M) Design Checklist
 - 88-6 Heat Distribution Systems Outside of Buildings
 - 91-7 Chlorofluorocarbon (CFC) Limitation in Heating, Ventilating and Air-Conditioning (HVAC) Systems
 - 94-2 Utility Meters in New and Renovated Facilities
- c. Military Handbooks
 - MIL-HDBK-1190 Facility Planning and Design Guide
- d. Corps of Engineer
 - Architectural and Engineering Instructions - Design Criteria
 - TI 809-04 Seismic Design for Buildings
- e. Other Standards and Codes
 - National Standard Plumbing Code
 - Uniform Mechanical Code
 - National Fire Protection Association (NFPA), Codes, Standards and Recommended Practices
 - American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standards
 - The Americans with Disabilities ACT (ADA)

13.2 DESIGN CONDITIONS:

The outside design temperatures used are based on AFM-88-29 (Engineering Weather Data). The inside design temperatures are based on MIL-HDBK-1190 (Facility Planning and Design Guide).

- a. Outside Winter
 - Dry Bulb: -26 degrees C. (97 1/2%) (-15 degrees F.)
 - Dry Bulb: -29 degrees C. (99%) (-21 degrees F.)
- b. Inside Winter
 - Administration Areas, Dry Bulb: 20 degrees C. (68 degrees F.)
 - Mechanical Room, Dry Bulb: 10 degrees C. (50 degrees F.)
- c. Outside Summer
 - Dry Bulb: 32 degrees C. (2 1/2%) (89 degrees F.)
 - Mean Coincident Wet Bulb: 16 degrees C. (61 degrees F.)
 - Daily Range: 0 degrees C. (32 degrees F.)
- d. Inside Summer
 - Administration Areas, Dry Bulb: 26 degrees C. (78 degrees F.)

Mechanical Room, Dry Bulb: (Outside design temp.) + (10 degrees F.) = 37 degrees C (99 degrees F.)

- e. Degree Days
Heating: 7671 per year
Cooling: 370 per year
- f. Elevation: 1074 meters (3525 feet)

13.3 THERMAL INSULATION FOR MECHANICAL SYSTEMS:

Insulation Materials shall be limited to mineral fiber, cellular glass, or flexible cellular insulation. Aluminum jackets shall be provided at wall and roof penetrations, and on piping exposed to weather. Aluminum jacket shall not be used on insulation susceptible to deformation due to crushing. Aluminum jacket securing bands shall be Type 304 stainless steel 0.8 mm (0.015-inch) thick, 13 mm (1/2 inch) wide. Duct board shall not be used.

13.4 HEATING, VENTILATING AND AIR CONDITIONING:

- a. Building space heating and domestic hot-water requirements will be met with the base wide high temperature hot water heating system. A high-temperature to low-temperature hot water heat exchanger shall be utilized to supply traditional low-temperature hot water to heating coils and/or fin tube located throughout the building. The design of the high temperature hot-water portion of the heating plant shall be in strict accordance with the existing system and operating controls, and match existing plants used throughout the base. All heating and chilled water system will be protected to a -30 degree F burst protection with a propylene glycol-water mixture. Air handling unit (AHU) preheat and heating coils shall utilize three-way fully modulating control valves. Terminal units; such as reheat coils, fan coils, fin tube, unit heaters and convectors shall be controlled by three-way modulating, three-way two position or two-way modulating control valves. Pump motors shall be sized to provide non-overloading operating over the entire pump curve. If two-way control valves are utilized, insure that there is sufficient heating water bypass to prevent pump dead heading and prevent pump overheating. Two-way control valves should be selected so that the pump head can not force them open. Redundant heating water pumps shall be provided and operate in an automatic lead-lag sequence. All valves shall be balanced by means of automatic flow control valves. All coils shall be furnished with strainers on the supply side. Temperature and pressure test plugs shall be installed shall be installed on the inlet and outlet of all coils, heat exchangers and chillers. All coils, heat exchangers and chillers shall be provided with a means of draining the device. All motor driven equipment shall be isolated from both the building structure and the mechanical piping system with appropriate vibration isolation devices. Cooling shall be provided through a either a chilled water plant or air-cooled condensing (direct-expansion

coil) system. Cooling coils shall be equipped with a self-draining, microbial resistance drain pan. Condensate from the cooling coil pans shall be routed to the nearest interior drain location.

- b. Ventilation shall be provided in accordance with ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality. If a variable air volume system is utilized, the system shall be designed to provide constant ventilation air through out the full range of the supply fan. All central air handling system shall employ an airside economizer. All ductwork shall be galvanized steel and constructed in accordance to latest Sheet Metal and Air conditioning Contractors' National Association, Inc. (SMACNA) standards. Fans and motors shall be high efficiency type. Fans shall be isolated from building structure and duct system through the use of appropriate vibration isolation devices.
- c. Building systems HVAC controls shall be direct digital type. Controls features shall include night setback, optimum start/stop, seven-day scheduling as well as heating and chilled water (if used) supply temperature reset. The HVAC system shall be tied into the existing base wide energy management and control system (EMCS). A new fiber-optics connection shall be supplied to the building to facilitate system tie-in. EMCS system shall monitor the following points:

- Chilled water supply & return temperatures (if used)
- Low temperature heating water supply & return temperatures
- High temperature heating water supply & return temperature
- Cooling plant status
- Heating water & chilled water (if used) pump status via differential pressure switch.
- Fan status via differential pressure switch
- Filter status via differential pressure switch
- Domestic hot water supply temperature
- Electric WHR Meter
- Gas Meter (if gas used)

All sequences of operations and control points shall be provided in system O&M manual.

- d. Testing and balancing shall be in accordance with the American Air Balance Council (AABC), National Energy Balancing Bureau or SMACNA requirements.
- e. Energy conservation measures such as air to air heat recovery, variable air volume, variable speed pump and others shall be incorporate when such measures are economically feasible

13.5 MECHANICAL ROOM:

All mechanical equipment shall be installed within the mechanical room or on grade outside the facility (no rooftop installations). Mechanical rooms shall allow for maintenance access. Floor slabs shall be sloped toward area floor drains. Pumps and other large floor-mounted equipment shall be mounted on housekeeping pads – (4”) minimum height. Gauges shall be mounted to be easily readable. A single pressure gauge shall be manifolded across each pump inlet, outlet, and inlet to the suction diffuser (if used); ball valves shall be used for isolation on the threaded black A53 steel gauge manifold. Glycol protected closed loops shall have automatic make-up units to provide a backup of propylene glycol/water mix. Thermometers shall be industrial dial type, not liquid filled “mercury” scale type, and shall be mounted in thermowells with conducting grease. Each closed loop system shall have a replaceable bladder type expansion tank, with the exception of the hot domestic water system, which may use a diaphragm type. Each air separator shall include industrial type air and pumps shall be provided with isolation valves. Manual air vents shall be located on the high points of closed loop systems shall have a chemical pot feeder for closed system treatment.

13.6 COMPUTER SIMULATION AND ENERGY BUDGET:

A computer simulation shall be performed for all new buildings using a program that is capable of performing an hourly analysis. The program may be used for equipment sizing and shall be used for an energy consumption analysis.

13.7 PIPING ZONES:

Domestic and HVAC piping shall be provided with zone isolation valves so those portions of each system may be isolated for operations and/or maintenance purposes without affecting the entire system.

13.8 PLUMBING:

- a. General: Interior domestic water piping and fittings shall be type L copper or PEX. Soil, waste and vent piping shall be no-hub cast iron. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs. Water supply piping shall not be buried under concrete floors. Floor drains shall feature trap primers. Provide water meter. Plumbing materials, installation, backflow prevention, and drainage shall meet the latest National Standard Plumbing Code requirements. Domestic hot water shall be provided by a high temperature hot water system. Summer and backup domestic hot water shall be provided, natural gas is preferred. Locate water heater as close as practical to point of use. Domestic hot water shall not exceed 120° F.
- b. Fixtures: Fixtures shall be water conservation types, in accordance with NAPHCC-01 National Standard Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance with Council of American

Building Officials CABO A117.1, Accessible and Usable Buildings and Facilities.

13.9 ENERGY MONITORING AND CONTROL SYSTEM (EMCS) – (ALSO SEE ELECTRICAL REQUIREMENTS)

The HVAC systems shall utilize direct digital controls and shall be connected to the base EMCS network to allow for remote monitoring and control at the base EMCS master control room. All equipment shall be compatible with existing Base equipment. Provide complete connection to existing base BACnet/IP system and interface to computer system in Building 471. This requires a fiber optic line to the nearest building with a working system FID. Specify direct digital controls compatible with the Base EMCS.

13.10 SEISMIC PROTECTION:

All mechanical equipment and piping shall be provided with anti-sway and support devices. The requirements for seismic protection measures described in this section shall be applied to mechanical/electrical equipment and systems specified herein. Lateral support against earthquake induced forces shall be accomplished by positive attachments without consideration of friction resulting from gravity loads. Equipment sway bracing shall include sufficient bracing for equipment to resist horizontal forces without exceeding safe working stress of bracing components. Support shall include but not be limited to ductwork, terminal boxes, heat exchangers, boilers, AHU's and water heaters.

13.11. Energy Budget Figure: The A-E shall determine and adhere to the energy budget figure in accordance with ETL 94-4 provided in design analysis.

13.12. Existing Energy Source: The source of heat shall be high temperature hot water from the central heat plant for commercial/industrial areas and natural gas for housing and designated remote base facilities.

13.13. Air Conditioning: Specify air conditioning be provided in all offices, administrative areas, and dormitory living areas in both new and renovated facilities.

13.14. Gas Service: Specify material be polyethylene plastic with plastic valves. Gas service, valves, and meters shall be installed in compliance with current national codes and gas standards.

BASE UNIQUE MECHANICAL DESIGN REQUIREMENTS LIST

The items listed in below are specific requirements created and identified for all architects, engineers and contractors to adhere to. They provide a solid basis to technically regulate the mechanical work relevant to Malmstrom AFB.

- * Design everything with maintenance ease and assess the priorities.
- * List salient features of all equipment specified, compatibility of products and materials
- * References appropriate codes - most current edition

1. Heat Exchange Gasket Type - Spiral flex
2. Design Heat Exchanger - Modulating valve located on return side of loop and check valve included
3. Heat Exchanger – Use welded and flanged fittings only.
4. Heating Coil - Use three-way modulating valve located on the supply side of coil
5. HTHW Valve Packing - Marlo 333
6. HTHW Valve - sliding gate (500 degrees F 500 psi HW)
7. Heating Pumps - 2 required
8. Chilled Water Pumps - 2 required in critical environment areas
9. Cooling Coil - Use three-way modulating valve on supply side of the coil
10. Circulating Pumps - To be located in the mechanical room
11. Pumps - Need isolation valves on inlet and outlet
12. Factory rep startup of all major mechanical systems (written checklist to be provided in the required format)
13. Training for Each System - By professional instructor and videotaped, minimum of 4 hours
14. Direct Digital Controls (DDC) - BACnet/IP installed in **every** new or renovation project. Use Malmstrom spec.
15. Energy Management Control System (EMCS) - BACnet/IP installed in **every** new or renovation project. Use Malmstrom spec.
16. EMCS - Thorough list of equipment and points required
17. Control Schematics - Laminated and mounted in mechanical room
18. Fiber Optic Cable for EMCS to every mechanical room
19. Furnaces - High altitude rated, high efficiency
20. Furnaces - All exhaust vents sloped $\frac{1}{4}$ inch per foot to prevent exhaust pipe freezing and carbon monoxide poisoning
21. Hot Water Heaters - High altitude, quick recovery, high efficiency
22. Boilers - High altitude, high efficiency
23. Utility Gas Lines – Underground: Use polyethylene valves and piping, full port valves.
24. Utility Gas Lines - 42" depth, plastic marking tape and metal tracing wire line
25. Utility Gas Lines - An anodeless riser assembly is required
26. Worker Qualifications - State qualifications for each trade to do work assigned
27. Copper Pipe Joints - All hidden joints to be SILFLOSS not soft solder; random joints may be inspected by destructive testing

28. Glycol Solution - Protect to minus 30 degrees F burst protection using propylene glycol, approx 50% solution.
29. Pipe - Flanges or unions after isolation valves and before coils, fin tubes, etc
30. Pipe and mechanical equipment shall be braced for earthquake protection
31. Plumbing - Do not put on outside wall because of freezing potential
32. Heating and Chilled Water - Use propylene glycol system
33. Protect and support all piping properly, especially the refrigerant piping
34. All gauges readable from the floor level
35. Access panels for all valves on unitary heating systems in buildings
36. Fan Coil - Access to change filters
37. Water Treatment - Use demineralized water, inhibitor and glycol match to existing chemicals for compatibility
38. Motors - Thermal protectors for overload with sealed bearings
39. Make Up Air Units - Not to inlet snow, rain, wind, ect.
40. Make Up Air Units - To have closed combustion chambers
41. Roof Ventilators - Direct drive type
42. Flex Duct - Use high quality type; radius over 45 degrees will be by hard duct.
43. Flex Duct – Length to be 4 foot or less where possible
44. Check for CFCs in project
45. Check for asbestos
46. Large AHUs - Use face and bypass concept
47. Design heating equipment for an outside temperature of -21 degrees F
48. Use low ambient temperature cutoffs for condensers
49. Self-Contained through Wall AC Units – Liebert
50. Provide utility meters for gas, electricity, BTUs from high temperature hot water, and water
51. Renovation - Engineers to verify utility connections, size, type, PSI, location, etc.
52. Coordinate designs with other design discipline
53. Mixed air portion of the AHU requires low temperature limits to prevent coil freezing
54. Velocitrols for VAVs to be Kreuter CSC-3011
55. Chemical Feeders - To be bypass pot feeders
56. Catwalks around suspended equipment
57. Electrical disconnects labeled to match equipment
58. Breaker Schedule - Have EE verify to equipment
59. Phase loss Protection of Equipment – Each installed electrical motor 3HP and greater shall have phase loss, phase unbalance, and phase reversal protection such that the motor circuit is interrupted in the event of a phase failure. When the phase failure is corrected the protection device shall automatically reset and allow normal motor operation.
60. Fire Suppression System - Must be designed by a Montana registered fire protection engineer
61. Fire Detection Transmission System - Must be made by Monaco, sole source justified

14.0. MAINTAINABILITY

14.1. Operating and maintenance manuals are to be prepared in accordance with ETL 89-2. Provide schematic diagrams (framed) for all systems.

14.2. Cathodic protection using the base impressed current system and sacrificial anodes shall be provided for all buried metallic structures and piping. See Section 11.10.

14.3. Particular attention shall be given to access for maintenance for mechanical and electrical equipment such as heating, ventilating, and air conditioning (HVAC) equipment, and access thereto.

14.4. HVAC control diagrams shall conform to ETL 83-1.

14.5. Specify lockable metal cabinet in each building mechanical room sized to store and secure one complete set of operating and maintenance manuals.

14.6. Specify contractor to provide an itemized list of all construction items/system warranties complete with warranty expiration dates for each item. Warranty data is to be included in the operating and maintenance manuals. List in submittal schedule.

14.7. Provide a "systems checklist" describing all tests and certifications required in the design for use during pre-final and final inspections.

15.0 COMMUNICATIONS/COMPUTER SYSTEMS:

15.1. Description of Base Telephone System: The base has a touch-tone system. Contact the base communications squadron for connection points to existing base system and for a copy of the current communication cable site plan.

15.2. Communications Rooms: A separate telephone room and separate electrical panel room shall be provided within the facility. There will be no electrical panels in the Telco room. Provide two 110v four-plex electrical receptacles to be located in the telephone room. Provide a 4'x8'x3/4' shellacked fire resistive plywood backboard to be installed in the telephone room.

15.3. Communication Wiring Requirements: Facilities shall be pre-wired to provide eight cable pairs to each duplex telephone receptacle from the telephone panel. Provide conduit from receptacles up to ceiling space. Conduit (3/4") from the telephone panel up to the ceiling shall also be provided. Plenum rated cable shall be used where required by NFPA standards. Provide level 5 LAN cable in designated location in each building.

15.4. Two 4-inch conduits with inner ducts as required shall be installed from building exterior into each telephone room to the existing pedestal or communications manhole as required.

15.5. EMCS: An underground fiber optic line must be run to the mechanical room of the nearest building that contains a working system FID. Contractor must verify signals at existing system FID.

15.5.1. Fiber Optics: Fiber optics cable core diameter must be 100 micrometers. The cable outside diameter must be 140 micrometers. Each fiber shall be continuous with no factory or field splices.

15.5.2. Ensure EMCS components including fiber optics connectors, EMCS temperature sensors and room sensors are compatible with base system.

16. SPECIAL CONSTRUCTION CONSIDERATIONS

16.1. Winter: The winter construction season starts IN LATE October and generally extends through April. During this period, freezing temperatures and snow should be expected. Industry standards and specific guidelines shall be specified for the use of all temperature/weather sensitive materials (i.e., concrete, paint, etc).

16.3. Construction Permit: Contractor shall obtain an approved AF Form 103, Base Civil Engineering Work Clearance Request, from base civil engineering prior to starting construction work. Excavation must be coordinated so representatives from the communications squadron or telephone company will know 24 hours in advance that excavation is scheduled and approved.

16.4. Hand Digging: Digging within 3 feet of existing communication and electrical cables and existing natural gas lines is to be performed by hand digging until the cable or line is exposed along its length. When existing utilities are reburied, install a marker along the length that was uncovered at 12 inches below finished grade. The marker tape shall be a 5 mil, plastic tape no less than 3 inches wide, brightly colored, with lettering to identify what the buried utility is below it. A metal locator strip shall be a part of the marker tape. For abandoned utility lines, remove the old piping, standpipes, and valve boxes back to the main. Depths for buried utility lines shall be 18 inches for communications, 24 inches for electrical low volt up to 600V, 30 inches for electrical high volt above 600V, and 42 inches for natural gas.

16.4.1. Access to Communications Manhole or Handhole: No communications manhole or handhole shall be entered without first obtaining a fiber optic cable briefing. Upon request from the contractor, construction management will arrange for a briefing from the base communications officer.

16.4.2. Utility Cuts: All repairs due to cable cuts on scope exchange cables shall be the responsibility of the contractor. Repair actions must be accomplished by the current

scope exchange contractor and paid for and coordinated under this contract. Work to restore lost service must begin within 1 hour after the cut and must continue unceasingly until the job is completed, tested, and accepted.

16.5. Utility Outages: All utilities programmed to be interrupted during construction shall be coordinated with base civil engineering at least 14 days in advance of the outage and at a time convenient for the government. The “utility outage notice” will be completed by the contractor and submitted to the base construction management office for approval. No interruptions shall be made until an outage notice is approved and returned to the contractor. Utilities will include all overhead and underground utilities and road closures or partial closures.

16.6. Repair of Road Cuts: Asphaltic surface shall be completely in place within 10 days after the road is cut. During the time between backfilling and paving, a base course-driving surface shall be installed and maintained by the contractor.

16.7. 1354 Checklist (Reference Appendix 4 and CTL 88-2): The contractor will complete the property inventory checklist and submit it to base civil engineering construction management office 10 days prior to final inspection. The checklists will be delivered to the contractor at the pre-construction conference.

16.8. Safety Regulations: The contractor shall comply with all OSHA, NIOSH, and EPA regulations.

16.9. Base Pass: All contractor personnel are required to have a base pass, which is obtained as directed by the contracting officer.

16.10. Grounds Maintenance: The contractor shall be required to maintain all lawn and native grass areas within the confines of fenced construction and staging areas. Maintenance shall include mowing and trimming, to maintain 3” grass height, watering and fertilizer to maintain healthy growth and weed control for the entire construction period. Specify damaged lawn areas shall be replaced with sod.

16.11. Government Furnished Equipment: It will be a design responsibility with base civil engineering’s assistance to obtain a listing of government-furnished equipment from the using agency for which installation mountings, mechanical and electrical or other provisions shall be required.

17. COMPREHENSIVE INTERIOR DESIGN

14.1. Each designated project shall receive a complete comprehensive interior design (CID) and structural interior design (SID). Reference Appendix 11 for guidance.

14.2. General Requirements:

14.2.1. The interior design shall provide a physically attractive environment in which the occupants can work and effectively communicate with co-workers. The design shall promote a sense of belonging and provide a feeling of comfort and convenience. Finishes and basic color schemes shall be selected to delineate the various areas. Carpet shall be used to tie various areas together and as a basis for all color schemes. Carpet shall be Class A fire resistive material with a smoke development rating of 400 or less and a flame spread of 0 to 25.

14.2.2. Provide a complete list of CID furnishings and cost to the user at 35% design completion stage for purpose of establishing a funding requirement in the stock fund system.

14.3. Design Considerations: Color should be used to add interest and vitality to the facility. Accent color can do much to brighten up and add interest to an otherwise uninteresting area or surface. Accent colors can be introduced in the office and administrative areas by the use of a different color paint on one wall or by using vinyl wall covering on one wall. Graphics can also be used to add interest and color in all common use areas, corridors, break rooms, or lounges. The architect is responsible for developing all color and material selections that are a part of construction. The CID service shall include:

14.3.1. Selection of furnishing authorized by a table of allowance and approved by the using agency/organization.

14.3.2. Preparation of a furniture layout plan and furniture illustration sheet.

14.3.3. Preparation of an itemized list of all furnishings, quantities required, source data, and cost.

14.3.4. Preparation of color boards, colors and finishes schedule, and proposed graphics system. All interior finishes must be selected for low maintenance qualities and high resistance to damage.

14.4. Furniture: All furniture including chairs, tables and vertical wall units should be selected to be scaled in proportion to the room size and available space.

14.5. Graphics and Signage: Signage includes building identification signs, room identification signs and numbers, direction signs, door name and card holders, and informational signs. Identification shall include but not be limited to offices, dorm rooms, conference rooms, toilet rooms, and facilities, lounge, stair, janitor, storage and vending machine rooms. The interior design should consider the use of graphics, pictures and other decorative items to enhance the interior design.

14.6. Submittals: The A-E shall provide complete color boards for each area at the 95% design stage. The submittal shall include product samples, product color and finish schedule, manufacturer's part numbers and color numbers for each area.

DRAWING REQUIREMENTS FOR THE 35% SUBMITTAL

A wing brief of all Major Projects is required at the 35% design phase. Examples of documents required at this briefing are attached.

NARRATIVE REQUIREMENTS

Official Project Title

Type of Project: (MILCON, O&M, NAF, MFH, etc)

Fiscal Year:

Project Number: (PDC, PCMS)

Location: (Installation)

Wing:

Designer:

Programmed Amount:

Current Working Estimate: (Include contingency and SIOH)

PA/CWE

Brief description of project: (Scope, using agency(s), parking, revised streets, infrastructure, etc.)

Brief statement of purpose of project:

Description of architectural style/features/exterior materials

Description of dominant exterior materials

Describe how the project meets the design problems/objectives [Reason(s) for selecting style/features/exterior materials]

Explain compatibility with surrounding facilities: (Include photos of surrounding facilities if necessary)

List/describe roof-mounted equipment and all utility equipment within 50' of facility

Describe basic interior design theme (finish materials, colors, etc.)

Appendix 1

DRAWING REQUIREMENTS FOR THE 35% SUBMITTAL

ELEVATION PERSPECTIVES:

These are to be sketches illustrating all the major elevations of the facility from a ground view. All existing and new utility equipment (air-handling equipment, transformers, meters, poles, etc.) that will be visible from that view of the finished facility will be shown, to scale, in its finished location, with an indication of finish color. ALL roof-mounted equipment, down to and including plumbing stacks, should be accurately shown if it will be visible on the finished facility. Streets, parking, sidewalks and all site amenities (benches, bicycle racks, screening, fences, etc.) must be accurately illustrated, along with signage, if included in the design contract. Building mounted lighting fixtures, lighting bollards and standards should also be shown. Landscaping is to be accurately shown at the size it will be at construction completion. The intent of these sketches is to show the facility from the ground level in its actual setting, as it will appear when construction is complete.

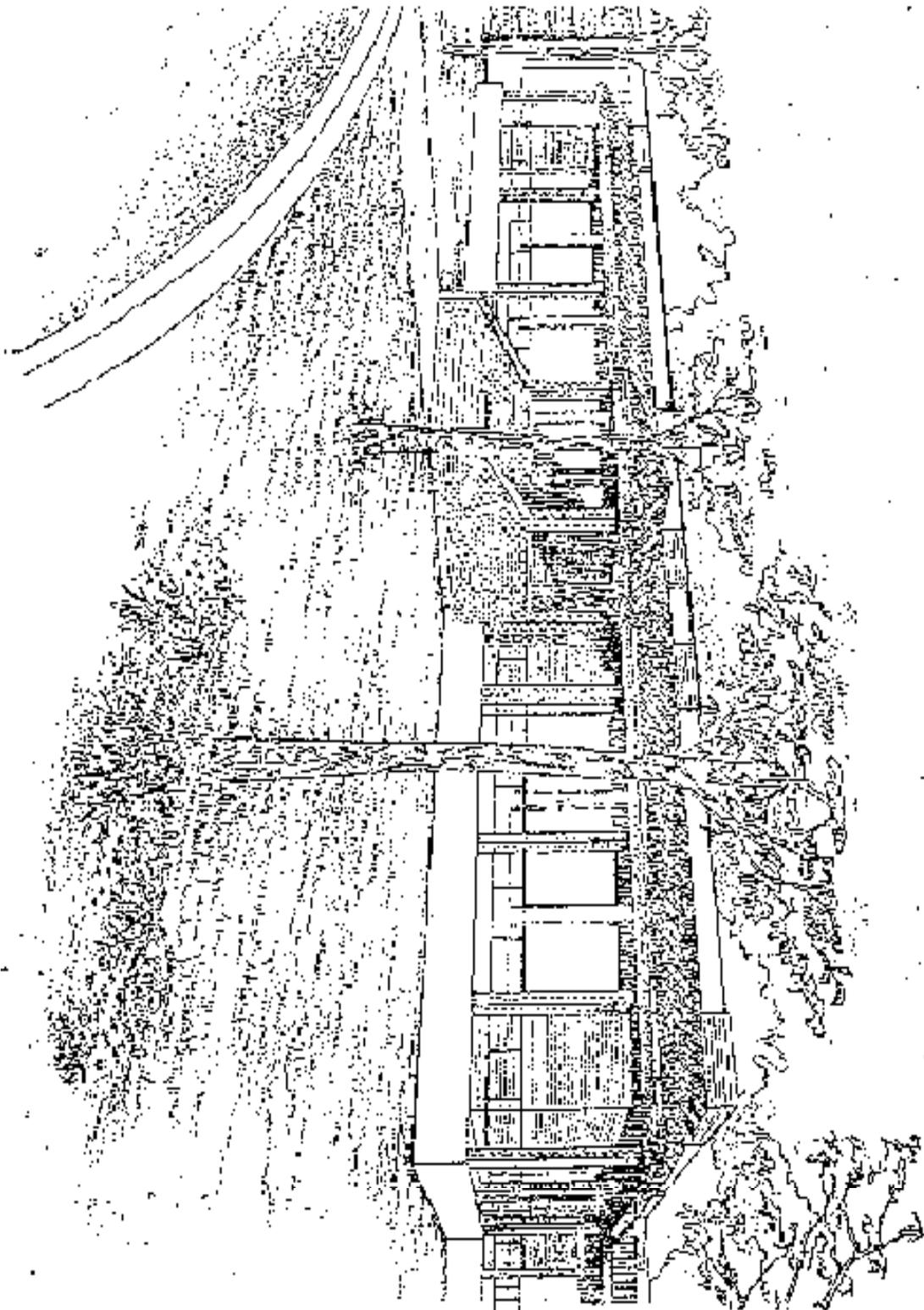
SITE PERSPECTIVES:

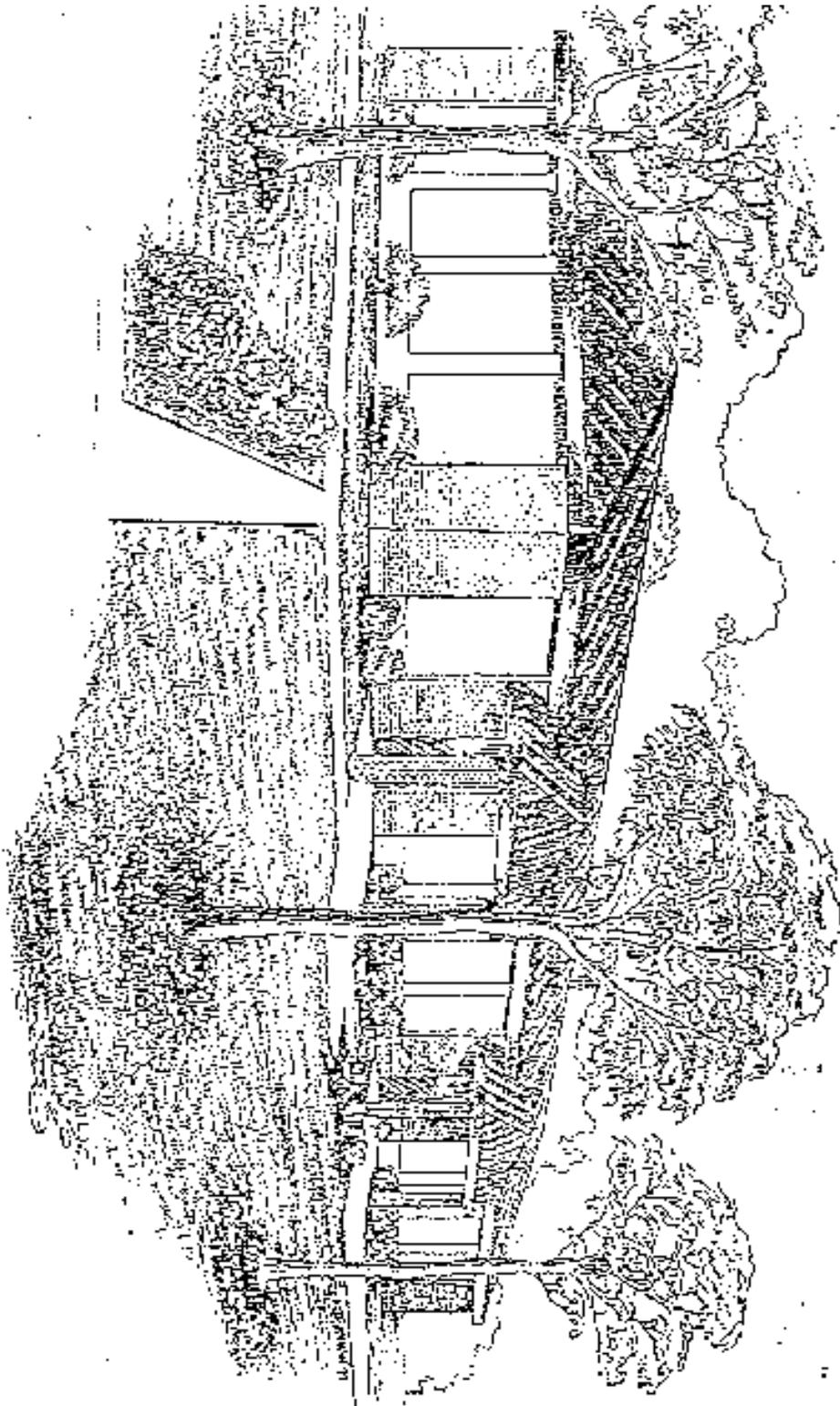
These are to be aerial sketches illustrating how the facility fits in the proposed setting. They should show all existing and new features over a broad view, including buildings, streets, parking, sidewalks, landscaping and all other site conditions. The intent is to show the integration of the facility with its surroundings, as it will appear when construction is complete. Normally more than one sketch will be required to show this integration in the several different directions.

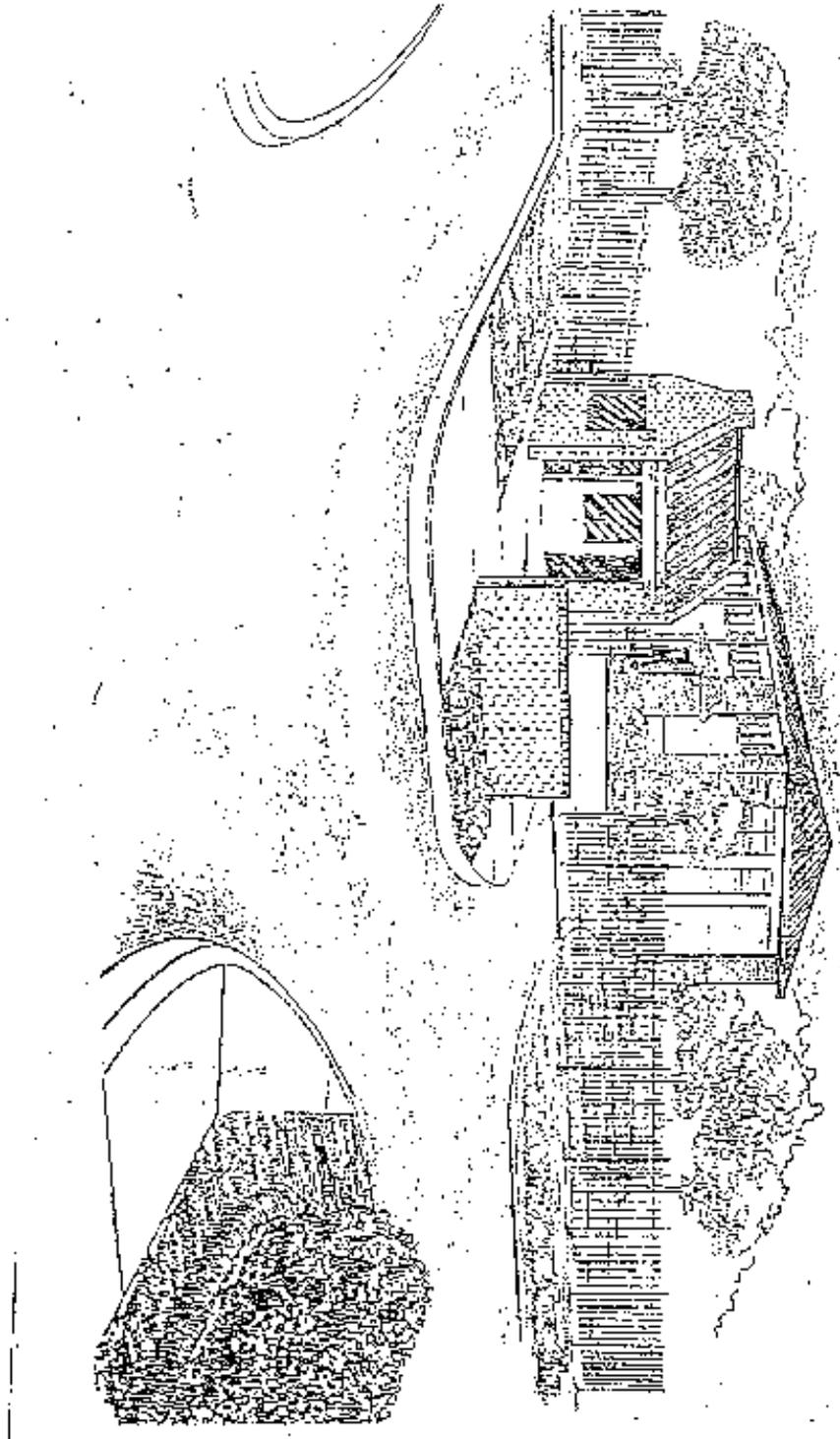
The above perspectives are to be simple 8 ½" x 11" black-line sketches with colored pencil or marker overlay, which can be reproduced on a normal color photocopy machine. They should provide an indication of color for the major design elements, without becoming full-blown renderings. People and cars can be included, if they help illustrate scale.

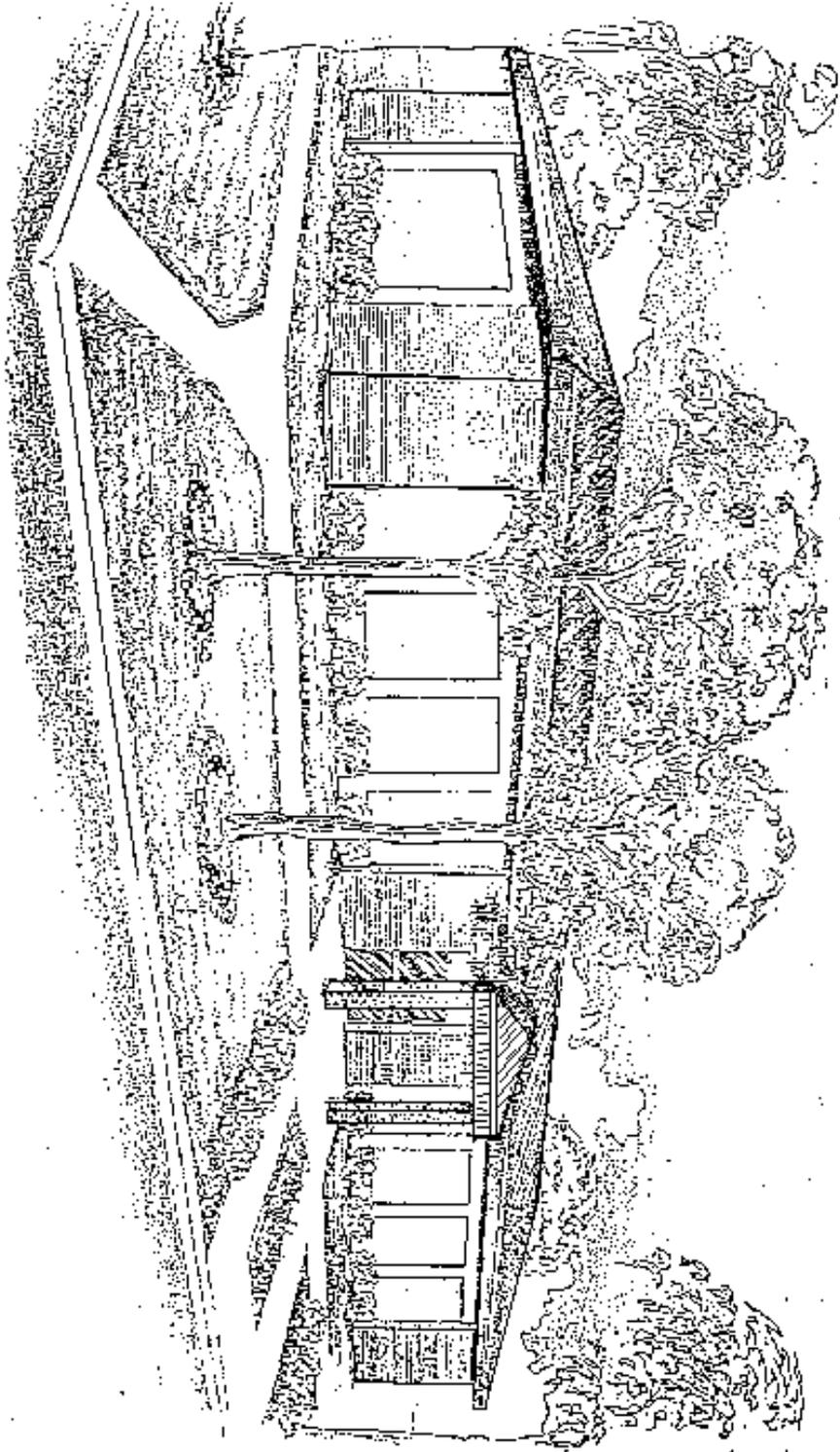
BUILDING, SITE, LANDSCAPING AND TRANSPORTATION PLANS:

These drawings are to be traditional two-dimensional plans, with or without color, and will normally be larger than 8 ½" x 11" to adequately illustrate the design details.









SECTION 01 00 00
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF WORK

Project titled:

Provide all items, articles, materials, operations, or methods listed, mentioned or scheduled on the drawings and/or as specified herein, including all labor, materials, equipment, and incidentals necessary and required for completion of the scope of this project.

1.2 UTILITIES:

All reasonable quantities of utilities will be made available from existing utilities to the Contractor without charge. Any temporary connection or lines that may be required will be installed, maintained, and removed by the Contractor at his own expense and in such a manner satisfactory to the Contracting Officer. Removal of such connections or lines will be accomplished prior to final acceptance of the construction. The Contractor shall provide any necessary portable power.

1.3 SAFETY:

The Contractor shall comply with all existing Occupational Safety and Health Act (OSHA) standards of safety at all times in the performance of this contract. Hazards to the safe use of the premises due to the Contractor's work and/or equipment shall be suitably marked at all times. Pedestrian and vehicle traffic ways shall be kept clear and unobstructed.

1.4 OMISSIONS

Omissions from the drawings or specifications or the misdescription of details of work that 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 work. This work is to be considered part of the base contract and no claims will be paid for the performance of this work.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 INSPECTION:

There will be one primary inspector assigned to inspect for compliance. An alternate inspector will also be assigned and will perform all inspection duties in the absence of the primary inspector. The inspector will be the spokesman for compliance with the specifications and drawings. Controversies between the inspector and the Contractor will be resolved by the Contracting Officer. If, for some reason, a change in the primary or alternate inspector is required, the Contractor will be notified. The Contractor shall coordinate Contractor activities with Construction Management.

3.2 CONTRACTOR VEHICLES AND EQUIPMENT:

3.2.1. The Contractor shall provide all vehicles and equipment necessary to accomplish the contract work. Power equipment shall be equipped with safety and noise limiting devices. The equipment shall be in a safe and efficient operating condition. The Contractor shall not park vehicles in the project area during non working hours. A designated parking area for vehicles and equipment will be provided. Vehicles will not be allowed on lawns or sidewalks without prior written approval. All equipment will be clearly marked with the Company name.

3.2.2. Truckload Limits: The following load limits shall apply to all contractor-operated equipment on this project:

April 1 to June 1	--	350 #/inch width of tire
All Other Times	--	400 #/inch width of tire

3.3 CONTINUED USE OF FACILITIES:

Building, structures, facilities, and utilities will continue in use by the Government during this contract. The Contractor shall notify Construction Management when a no-work condition will occur for more than one day by the Contractor or sub-contractors (except weekends and federal holidays).

3.4 MAINTENANCE OF AIR FORCE OPERATIONS

It is required and essential that the primary use of the facilities continue uninterrupted throughout the contract period. Work, once commenced, shall be carried to completion with a minimum of interruption to Government operations.

3.5 AS-BUILT FIELD DATA

3.5.1. General: The Contractor shall keep at the construction site a complete set of full size prints of the contract drawings, reproduced at Contractor expense. During construction, these 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:

Appendix 2

3.5.1.1. The locations and descriptions of any utility line and other installations of any kind or description known to exist within the construction area. The location includes dimensions to permanent features, and depth.

3.5.1.2. The locations and dimension of any changes within the building or structure, and the accurate location and dimension of all underground utilities and facilities.

3.5.1.3. Correct grade or alignment of roads, structures, and utilities if any changes were made from contract plans.

3.5.1.4. Correct elevations if changes were made in site grading from the contract plans.

3.5.1.5. Changes in details 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 size, pipe material, insulation material, dimensions of equipment foundations, etc.

3.5.1.6. The topography and grades of all drainage installed or affected as part of the project construction.

3.5.1.7. All changes or modifications from the original design and from the final inspection.

3.5.1.8. 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.

3.5.1.9. 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 mark-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 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 pay estimate. If the As-Built Field Data is not accurate and complete, a percentage of the pay request will be withheld from the payment and any future payments until the As-Built Field Data is up to date, complete and accurate. The Contracting Officer will determine the percentage to be retained.

3.5.2. Submittal of the As-Built Field Data: The As-Built Field Data shall reflect the exact installation performed and two copies shall be submitted to the Contracting Officer for review and approval a minimum of three 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 to the Contracting Officer within 10 calendar days of receipt. The "Red LINE" drawings shall be reviewed at the final inspection for completeness. Once As-Built Field Data have been reviewed and approved one copy will be returned to the contractor with an electronic copy of contract drawings. The electronic contract drawings will be updated with the field data by the contractor and submitted to the Contracting Officer.

3.5.3. Preparation--As-Built Contract Drawing, Non AutoCAD Original Mylar Record Tracing:

3.5.3.1. Approved preliminary as-built drawings will be returned to the Contractor along with one set of the contract drawing original record tracings. These drawings are part of the permanent records of this project and the Contractor will be held responsible for their protection and safety until they are returned to the Contracting Officer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced in like medium, quality and size as the originals at the Contractor's expense. The drafting work shall be performed by certified Engineering Technicians and/or individuals with a minimum of five years drafting experience.

3.5.3.2. Drafting of the data onto the contract drawing original mylars shall be done in a quality equal to that of the originals. Linework, lineweights, and lettering, and use of symbols shall be the same as the original line work, line weights, and lettering, and symbols. All revisions shall be noted in revision block with revision symbol in chronological sequence. This symbol shall also be placed on drawing where revision was made. If additional drawings are required, they shall be prepared on the same medium and of equal size and quality as the original drawings. When final revisions have been completed, each drawing shall be lettered or stamped with the words "As-Built" in block letters at least 3/8 inch high placed above the title block of 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. Markings on the reverse side of the drawings will not be permitted. The submittal shall include the approved "Red Line" drawings and the revised original record drawings as stated above.

3.5.4. Preparation--As-Built Contract Drawings, AutoCAD Original Record Drawings:

3.5.4.1. Approved preliminary as-built drawings will be returned to the Contractor along with AutoCAD CD of the original drawings. All as-built work will be accomplished by a Certified Engineering Technician and/or individuals with a minimum of five years drafting experience, at least three of which must be using AutoCAD. The name and

qualifications of these individuals shall be submitted in writing to the Contracting Officer for approval.

3.5.4.2. Modifications to the drawings shall be accomplished on the appropriate layer showing the work being changed. All revisions shall be done in the same format as the original drawing. On each sheet the words "AS BUILT" in block letters will be added to the drawings. The size of the letters will be at least 3/8 inch high and be placed either above the title block or to the left of the title block. Fill in the revisions block with "REVISED AS-BUILT", date and initials. The submittal shall include 2 CD copies of the revised AutoCAD drawings, the approved "Red Line" drawings and a full size plot of the drawings from the revised drawings.

3.5.5. The final as-built submittal shall be completed and returned together with the approved preliminary as-built drawings to the Contracting Officer within 30 calendar days of the final inspection. The Contracting Officer will review all final as-built record drawings for accuracy and conformance to the drafting standards and other requirements contained herein. The submittal shall be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the submittal to the Contracting Officer within seven calendar days of receipt.

3.5.5.1. All costs incurred by the Contractor in the preparation and furnishing of as-builts 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.

3.5.5.2. List of Equipment-In-Place: In addition to the above requirements, the Contractor shall submit for approval, at the completion of construction, a list of equipment-in-place. 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.

3.5.5.3. In addition to the above requirements, one set of marked-up as-built blueprints shall be furnished to the Contracting Officer at the time of system acceptance testing. These as-built prints shall be in addition to the requirements stated for the submission of the Operation and Maintenance Manuals.

3.6 CONCEALED WORK

All items of work to be concealed shall be Government inspected prior to concealment.

3.7 OPERATING AND MAINTENANCE INSTRUCTIONS:

Four complete sets of instructions, each in post-form binders, containing the manufacturer's operating and maintenance instructions for all equipment shall be furnished to the Contracting Officer. Where information or instructions are included for more than one model, the Contractor shall clearly mark the model actually installed on the job. The manuals shall be sectionalized using dividers with labeled tabs identifying the product/item behind the dividers. One complete set shall be furnished at the time test procedures are submitted, and the remaining sets shall be furnished before the contract is completed. Furnishing operating and maintenance instructions does not relieve the Contractor of the responsibility of furnishing framed instructions and schematics where specified. Each binder shall be indelibly marked on the exterior front and edge with the project name, project number, contract number, name of contractor and the date.

3.8 CONTRACTOR FURNISHED EQUIPMENT DATA:

Ten days prior to final inspection and acceptance of work, the Contractor shall submit the following data:

3.8.1. Equipment List: An itemized equipment list showing unit retail value and nameplate data including serial number, model number, size, manufacturer, etc., for all Contractor furnished electrical and mechanical equipment installed under this contract.

3.8.2. Guarantees: Provide a list of all equipment items which are specified to be guaranteed, accomplished by a copy of each specified guarantee therefore. For each specific guaranteed item on the list shall include the name, address, and telephone numbers of the subcontractor who installed the item, the supplier, or distributor and the manufacturer. The completion data of the guarantee period shall correspond to the applicable specification requirements for each guarantee item.

3.9 MODEL UNITS (Delete if N/A)

When model units are required, one model unit will be inspected at all key stages of construction. All deficiencies noted during these various inspections will be corrected prior to proceeding with the work schedule. No exceptions.

3.10 SHOP DRAWINGS:

Shop drawings will include specially prepared technical data for this project and will consist of drawings, diagrams, performance curves, schedules, calculations, measurements, and will expand the general application to this specific project. Shop drawings show complete and accurate descriptions of specific equipment or systems to be installed. This will include detailed drawings showing routings, material types, installation and anchoring methods, component sizes, mounting methods, spacing, interface with existing systems, wiring and electrical systems, and all other details associated with the installation.

3.11 START OF WORK NOTIFICATION:

The Contractor shall notify the Construction Management (CM) Office (731-6156) and the Contracting Officer at least five work days in advance of the start of all work. This shall include, but is not limited to, notifying CM when the initial work shall begin; notifying CM when work shall resume after a work stoppage of more than three work days; notifying CM when work shall begin following the end of all specified exclusion periods. The Contractor shall be aware that the Notice to Proceed is not sufficient notification to CM when initial work will begin.

3.12 NOTICE OF FINAL INSPECTION:

The Contractor shall, after notifying the Project Inspector, schedule a date with the Contracting Officer for final inspection 14 days prior to his projected completion of the project. A final inspection shall not be held until all discrepancies found during the pre-final inspections have been corrected. The red line drawings shall be at the final inspection.

3.13 CONSTRUCTION NEAR UTILITY SYSTEMS:

3.13.1. All contractors shall be responsible for processing their own **Work Clearance Request (AF Form 103)** and coordinating with Government inspectors as required. The contractor is responsible for obtaining all coordination signatures for the permit. The approved permit shall be valid for a period not to exceed 90 calendar days. **TO THE MAXIMUM EXTENT POSSIBLE, ELIMINATE PERMANENT MARKINGS ON PAVEMENT AND CURBS.** The contractor shall be responsible for maintaining all utility markings. Location marks shall be removed after 14 calendar days if not used. All markings shall be accomplished with water-based chalk (Aervoe Pacific Inc. 1-800-227-0196 or equal). No paints will be used. **Detailed permit procedures and guidelines shall be provided to the contractor during the Pre-performance Conference.** Digging within three feet of buried communications cables, environmental monitoring wells, electrical cables, irrigation systems, and gas lines shall be performed by hand digging until the utility is exposed. The Project Inspector shall be notified three days prior to digging within a three-foot area near this utility. A representative from communications must be present during excavation of Communications Cables. The cable piping routes must be marked prior to excavation in the area. The Contractor shall be held responsible for any damage to a marked or identified utility by excavation procedures. Once the utility is exposed, mechanical excavation may be used if there is no chance of damage occurring to the cable or piping system. The contractor is responsible for marking all excavations he will do, five (5) work days prior to needing existing utilities marked by the government.

3.13.2. Reburial of Exposed Utilities: When existing utility lines are reburied, a tape, detectable by pipe detector systems, shall be installed above the uncovered length of the utility at a depth of 12 inches below grade. Tape shall be a minimum five mil plastic

tape with metallic tracer, minimum three inches wide, lettering on tape to show buried utility, and brightly colored.

3.13.3. Access to Communications Manhole or Handhole: No communications manhole or handhole shall be entered without first obtaining a fiber optic cable briefing. Coordinate through Construction Management with the Base Communications Officer.

3.13.4 All repairs due to cable cuts on scope exchange cables shall be the responsibility of the Contractor. Repair actions must be accomplished by the current scope exchange contractor and paid for and coordinated under this contract at no additional cost to the Government if the contractor is deemed to be at fault by the Contracting Officer. Work to restore lost service must begin within one hour after the cut and must continue unceasingly until the job is completed, tested, and accepted. Work will be inspected by Communications Squadron and scope exchange personnel.

3.13.5 Definition of unmarked utilities: under this contract unmarked utilities that can be considered differing site conditions will be defined as, and paid for, per each live or abandoned utility crossing encountered during excavation that is not shown on the plans and is not located in the field. If two or more unidentified utilities are located within 3 feet of each other, they will be paid for as a single unidentified utility crossing. If an abandoned utility can be removed under normal trenching procedures, then no additional payment will be made. For example abandoned electrical lines that are trenched through with no significant delay do not constitute payment for an unmarked utility. Payment will be made at the contract unit price per each including all lost crew time, delays, down time, and all other work necessary or incidental for completion of the item. Payment for this item requires the notification of an inspection by the Contracting Officer Representative at the time of discovery as well as documentation of the crossing on the as-built drawings.

SPECIFIER: DELETE IF NOT APPLICABLE

3.13.5 EXCAVATION/BORING REQUIREMENTS IN THE WSA

3.13.5.1 There will be a formal (written) procedure for all contractors conducting excavations/borings in the Weapons Storage Area (WSA). This procedure is effective immediately and will be acknowledged by the contractor and inspector (signed statement).

3.13.5.2 A site visit will be scheduled by the Project Inspector within 24 hours of notification by the Contractor, for the purpose of identifying all hand /hydrovac excavations required by the Contractor. The site visit will be attended by the Contractor, Project Inspector, Communications Squadron, and all CE shops with buried utilities in the immediate area.

3.13.5.3 The contractor will not be allowed to excavate/bore without an inspector present on site.

3.13.5.4 All CE shops with buried utilities located in the immediate area of the excavation/boring will be present at all times during the excavation/boring operations. Do not excavate or bore until inspector confirms presence of all required shops.

3.13.5.5 If communications lines are involved, ensure that the Communications Squadron has been notified and asked to be present during any excavation/boring operations.

3.13.5.6 CE will be notified by the contractor 48 hours in advance of any excavation/boring operations to be conducted within the WSA.

3.13.5.7 No contractor will be allowed to work in the WSA under any circumstances if CE inspector support is not available. This means that the contractor will be allowed to work only hours that a CE inspector is available, normal working hours per the contract.

3.13.5.8 Digging within five feet of buried utilities shall be performed by either hand excavation or hydrovac methods. This is a change from paragraph 3.13.1.

END OF OPTIONS

3.14 UTILITY OUTAGES

All utilities programmed to be interrupted during construction shall be scheduled at least 14 days in advance of the outage and at a time convenient for the government. The "Utility Outage Notice" will be completed by the Contractor and submitted to Construction Management for approval. No interruptions shall be made until the outage notice is approved and returned to the Contractor. Notification forms that are to be filled out by the contractor, will be provided at the pre-construction conference. Utilities will include all overhead and underground utilities and road closures or partial closures.

3.15 SUBMITTALS

Contractor shall submit four copies of all submittals, to be recorded on AF Form 66. Submittal items, including samples, shall be marked with a number corresponding to the item number on the AF Form 66, and the page and paragraph number of the specification requiring the submittal. Contractor shall hi-lite specifics when submitting catalogs, etc. It is the **responsibility of the contractor to complete column 13, "Required Submission Date", in the submittal form** and insert dates for each submittal item not already designated by the Government as having a mandatory due date. The contractor shall schedule and submit all required items for major systems (such as HVAC, etc) at the same time to enhance review of interrelated components. It is the Contractor's responsibility to ensure the dates provided on the form do not create any delays in construction. Provide the completed form to the Contracting Officer at or prior to the Pre-Construction meeting. The completed form will then be used by the

Government for tracking submittal progress. **If the contractor is proposing to use an exact brand name or product specified, a submittal for that item is not required.** In lieu of a submittal, the contractor shall submit a letter to the Contracting Officer outlining each item that will be provided exactly as specified. These items will also be annotated as such on the AF Form 66. Even though a specified product is provided, in some circumstances a submittal may still be required for color selection, etc. If a recycle initiative product is specified and the contractor wishes to provide a substitute product, the Contractor shall request the substitution as indicated in paragraph 3.28 of this Section.

3.16 CONTRACTOR STORAGE AREA AND WORK SITE:

Prior to notice to proceed, Contractor will be provided a storage area on the base within three miles of the project site or as designated on the site plan. **All** contractor equipment and materials shall be stored in this area except for materials that will be used on the job within a 48 hour period. Contractor is responsible for the security of assigned storage area (3,000 S.F., more or less). Temporary storage buildings (excluding tractor trailers) sited in the storage area shall conform to the base color scheme (Antique Linen, Fed. No. 23578). Architectural and structural features of all temporary facilities (including tractor trailers) shall be maintained in good repair as required by the Contracting Officer. Storage areas shall be enclosed by 6' chain link fence with access gates. Spare keys to any locked gates shall be provided to the base fire department dispatch office. Storage areas and job sites shall be clean, orderly, and free of debris, demolished/excess materials, etc. Job sites will be cleaned daily and refuse and debris removed from the site. Fences will be constructed of

“SPECIFIER SELECT ONE OF THE FOLLOWING”

a 6 foot tall chain link fencing / orange safety fencing (orange safety fencing may only be called out for situations in which chain link fencing is not feasible.) and will be maintained. Grass and weeds shall be cut weekly at the storage area and work site. If at any time during the life of the contract, the Contracting Officer determines that base standards are not being met, he/she may direct the Contractor to perform such actions as necessary to bring the area and/or facilities up to base standards at no additional cost to the Government. If the contractor fails to bring the area and/or facilities up to standards, the Contracting Officer may direct the Contractor to remove themselves and/or the facility/storage unit or materials from the base at no cost to the Government.

3.17 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.

3.18 QUALITY CONTROL

3.18.1. General. THE CONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL WHICH IS CONSIDERED BY THE GOVERNMENT TO BE A MAJOR INSPECTABLE ITEM OF THIS CONTRACT. In addition to CONTRACT CLAUSE, INSPECTION OF CONSTRUCTION, the Contractor shall comply with the Quality Control Provisions as specified herein. The Contractor shall perform all Quality Control inspection and/or testing required by this contract unless specifically designated to be performed by the Government. The Quality Control system must consist of personnel, plans, procedures, and organization necessary to provide materials, equipment, workmanship, fabrication, construction, and operations which comply with contract requirements. The system shall cover construction operations, including fabrication both on-site and off-site, and shall be keyed to the proposed construction sequence. If the Contractor fails to submit an acceptable Quality Control Plan within the time herein prescribed, the Contracting Officer will refuse to allow construction to start.

3.18.2. Quality Control Plan: General: Prior to the start of construction, the Contractor's Quality Control Plan must be accepted by the Government. Construction will be permitted to begin only after acceptance of the contractor's Quality Control Plan. The Contractor's Quality Plan shall identify the personnel, procedures, instructions, records, forms, and as a minimum, shall include the following:

3.18.2.1. A description of the Quality Control management organization including an organizational chart.

3.18.2.2. The number, classifications, qualifications, duties, responsibilities, and authorities of personnel: A copy of a letter, signed by an authorized official of the firm, which describes the responsibilities and delegates the authorities of the Quality Control manager shall be furnished. The Quality Control manager must have a minimum of five years of documented experience in the primary areas of construction included in this contract. Include qualifications in the submitted plan for Government approval.

“SPECIFIER SELECT ONE OF THE FOLLOWING”

1. This contract requires a full time Quality Control Manager to be on site daily and continuously when any construction activity is taking place. This individual may not have any other assigned functions within the contractor's organization.

or

2. This contract does not require a full time Quality Control Manager. The individual assigned may have other duties within the contractor's organization but must commit a minimum average of two hours per day towards fulfilling the QC requirements of this section. Hours dedicated to this function will be annotated on the submitted QC records.

“END OF OPTIONS”

Appendix 2

3.18.2.2.1. The Contractor's Quality Control activities to be performed, include those of subcontractors, off-site fabricators, and suppliers. A job specific detailed work item list for inspection purposes will be developed by the contractor. The list will be broken into sections identical to the contract specifications and will contain all inspection actions necessary to ensure full compliance with the contract. A sample from a simplified and generic project is included as Attachment 1 to indicate the level of detail expected in this checklist.

3.18.2.2.2. Quality Control testing procedures including corrective actions to be taken where non-compliance is noted by the Quality Control Manager.

3.18.2.2.3. Documentation format for Contractor's Quality Control activities and testing. The attached form is to be used for documenting daily inspections, corrective actions, etc.

3.18.2.2.4. Procedures for ensuring As-Builts are accurate and updated daily.

3.18.2.2.5. Safety program that ensures complete compliance with OSHA and the U.S. Army Corps of Engineers manual EM 385-1-1, Safety Health Requirements Manual. Any non-compliance issues are the responsibility of the Contractor and not the Government.

3.18.2.2.6. Methods to ensure scheduled appointments are met and documentation to verify arrival and departure times at the work site.

3.18.2.2.7. A listing of all required mechanical and electrical testing, balancing, and operational tests.

3.18.3. Acceptance: The Quality Control Plan will be reviewed and approved, if acceptable, by the Contracting Officer. The Contractor shall make such changes and additions necessary for clarity and completeness as requested by the Contracting Officer. Acceptance is conditional and the Government reserves the right to require the Contractor to make changes in the Quality Control Plan, personnel, and operations to correct deficiencies found by the Government during performance of work. No change shall be implemented prior to acceptance in writing by the Contracting Officer. Non-compliance with the Quality Control Plan will result in one or more of the following actions as the Government's discretion:

3.18.3.1. Directed removal and replacement of the QC Manager.

3.18.3.2. Reduced progress payments until corrections are made.

3.18.3.3. Cure notices and other applicable contracting actions up to and including possible contract termination for default.

3.18.3.4. Other contractual actions deemed appropriate by the Contracting Officer.

3.18.4. Quality Control Records: The Quality Control Records shall contain a record of daily inspections for all work accomplished. Specific items of work checked each day will be annotated. All work-in-place must be certified as complying with the contract plans and specifications. Non-compliance items must be clearly noted. Corrective actions must be outlined and detailed for non-compliance items. The Contractor shall maintain daily records, which will be on-the-job site and available for review by the Contracting Officer or his technical representative. Daily reports will be signed by the designated Quality Control Manager and will indicate hours spent on Quality Control that day. A copy of the QC daily reports shall be given to the Contracting Officer by noon on the following day.

3.18.5. Submittals: The contractor will submit four copies of the proposed Quality Control Plan for acceptance not more than 15 days after Award. No work will start until acceptance is made by the Contracting Officer. No exceptions will be provided to this requirement.

3.19 1354 CHECKLIST

Contractor will complete the Property Inventory checklist and submit it to the Contracting Officer 10 days prior to final inspection. Prior to completing the Form 1354 checklist, the Contractor shall request assistance from the Resource Management Flight. The checklist will be delivered to the Contractor at the Preconstruction conference.

3.20 PROGRESS SCHEDULE

Prior to start of work the contractor must have an approved progress schedule, AF form 3064. If the contract used sub-CLIN's in specification section 01 00 10 than the progress schedule must be broken down by these sub-CLIN's unless the Project Engineer gives permission to use other means of measuring progress.

3.21 WORK SCHEDULE

Working hours for the Contractor will normally be between the hours of 7:45 a.m. and 4:15 p.m. excluding Saturdays, Sundays, and Federal Holidays. If the Contractor desires to work during periods other than above, additional government inspection forces may be required. The Contractor must notify the Contracting Officer three days in advance of his/her intention to work during other periods to allow assignment of additional inspection forces when the Contracting Officer determines that they are reasonably available. If such force is reasonably available, the Contracting Officer may authorize the Contractor to perform work during periods other than normal duty hours/days. However, if inspectors are required to perform in excess of their normal duty hours/days solely for the benefit of the Contractor, the adjustments to the contract price may be made periodically as directed by the Contracting Officer.

3.22 NUCLEAR DENSOSMETERS

The use of nuclear densimeters or other devices containing radioactive elements on Malmstrom AFB is controlled for safety and management purposes. The contractor must have proof of a Nuclear Regulatory Committee (NRC) permit for its use. The Contractor must also keep all radioactive equipment locked up when not in use and remove it from the base at completion of the work day. All projects requiring use of radioactive devices will be required to submit, for approval 30days prior to use, the following information for review by the Base Radiation Safety Officer in (341 MDOS/SGOAB, Fax 406 731-2469):

1. Brief description of proposes activity.
2. Copy of current NRC or Agreement State License with NRC form 241
3. Name, address, phone number of responsible local representative and Radiation Safety officer (RSO) named on their license.
4. Copy of part of the Air Force Contract describing work to be done and inclusive dates of the work.
5. An acknowledgement that the installation RSO can make periodic checks on use of the equipment.

3.23 PROJECT SIGNS

The Contractor shall provide and install a project sign located as approved by the Contracting Officer. Sign shall be per the two Project Sign sheets (Attachment 2) that follow this section.

3.24 REFERENCES

All references listed in these specifications are intended to be the current version or edition, unless specifically identified otherwise.

3.25 ENERGY EFFICIENT PRODUCTS

All equipment supplied under this contract that requires energy usage shall be ENERGY STAR compliant.

QUALITY CONTROL REPORT TO INSPECTOR

Date: _____

CONTRACT NO. F24604-	TITLE AND LOCATION MALMSTROM AFB MT				REPORT NO.	
CONTRACTOR (Prime or Subcontractor)			NAME OF SUPERINTENDENT OR QC REP			
WEATHER			TEMPERATURE			
WEATHER EFFECTS						
PRIME CONTRACTORS/SUBCONTRACTOR WORKFORCE (If space provide below is inadequate, use additional sheets)						
NUMBER	TRADE	HOURS	EMPLOYER	ACTIVITY/TASK PERFORMED	COMP	NON COMP
TOTAL WORK HOURS ON JOB SITE THIS DATE _____			KTR INITIALS CERTIFY INSPECTION OF ACTIVITY		INITIALS	
CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT _____			WERE THERE ANY LOST TIME ACCIDENTS THIS DATE?			
TOTAL WORK HOURS FROM START OF CONSTRUCTION			<input type="checkbox"/> YES <input type="checkbox"/> NO			
			IF YES, A COPY OF THE COMPLETED OSHA REPORT IS REQUIRED			

CONSTRUCTION AND PLANT EQUIPMENT LEFT ON JOB SITE UNTIL USE IS COMPLETED

DESCRIPTION	DATE FIRST ON JOB (FIRST TIME ONLY)	HOURS WORKED THIS DATE	HOURS IDLED	DATE OF FINAL REMOVAL FROM JOB SITE

CONSTRUCTION AND PLANT EQUIPMENT NOT LEFT ON JOB SITE PERMANENTLY (This will include pickup trucks and mobile mounted items, such as compressor, that are also used for transportation to and from the job)

DESCRIPTION	HOURS WORKED	HOURS IDLED

Appendix 2

CEC FL-11 (3/97)

Attachment 1

SPEC PARA AND/OR DRAWING NO.	LOCATION AND DESCRIPTION OF DEFICIENCIES (Materials, Equipment, Safety, and/or Workmanship) ACTION TAKEN OR TO BE TAKEN

REFERENCE

DEFICIENCIES CORRECTED THIS DATE	REPORT NO.	COMPLIANCE NOTICE NO.

INSPECTION AND/OR TESTING PERFORMED TODAY-FOLLOW WITH REPORT	LOCATION AND/OR ELEMENT OF WORK	REMARKS RESULTS OF INSPECTION/TESTING

SPEC PARA/ DRAWING NO.	EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (Description, Sizes, Quantity)	SUBMITTAL NO. OR CERTIFICATION	DATE APPROVED

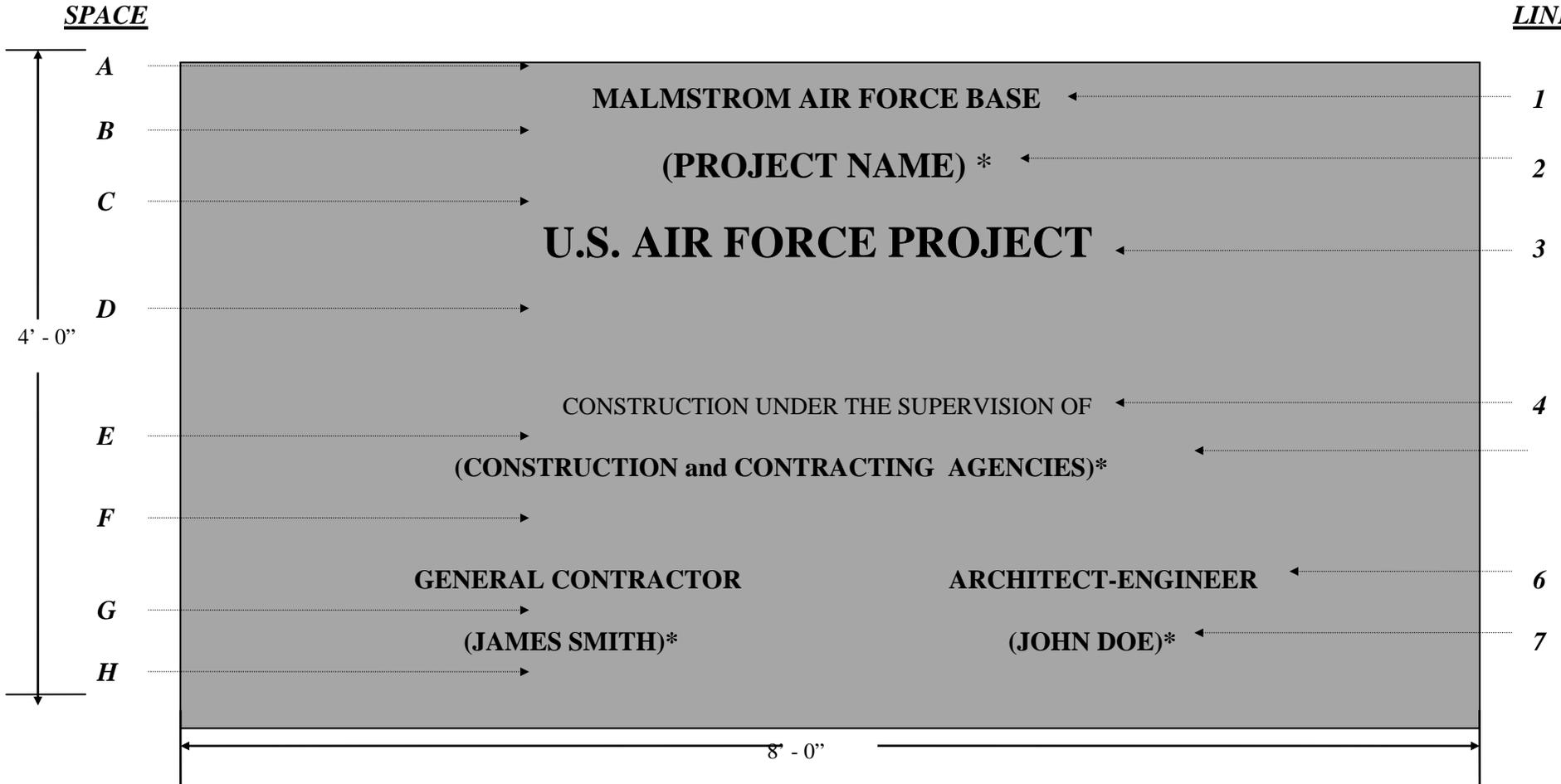
REMARKS:
(Document Total QC Hours for this Day, Directions Received from Government, and Compliance Notices, Etc)

Quality Control Rep Date

CONSTRUCTION REPRESENTATIVES REMARKS AND/OR EXCEPTIONS TO THIS REPORT

Construction Representative Date

Attachment 1

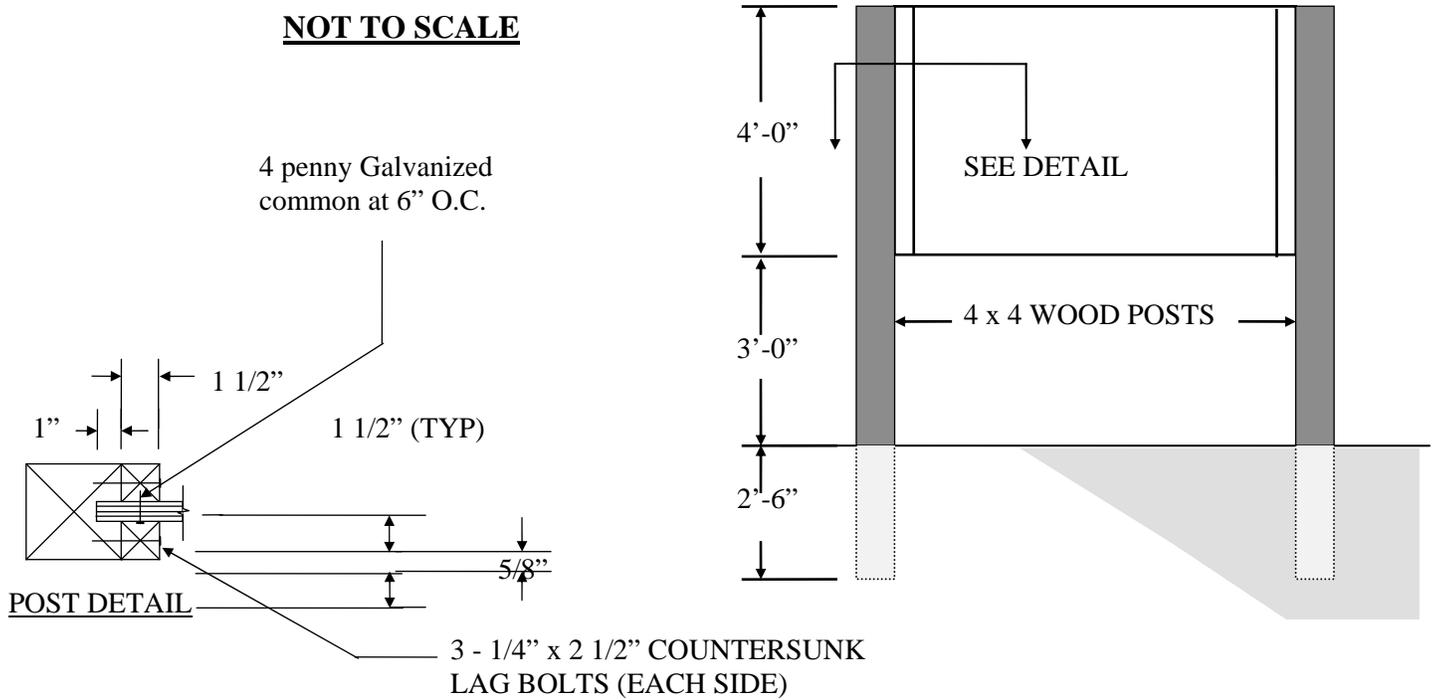


**SAMPLE CONSTRUCTION SIGN FOR PROJECTS
SCHEDULE**

SPACE	HT	LINE	DESCRIPTION	LETTER HT.	STROKE
A	2"	1	MALMSTROM AIR FORCE BASE	2 3/8"	1/4"
B	2 5/8"	2	* WILL VARY	2 3/4"	3/8"
C	5 3/4"	3	U.S. AIR FORCE PROJECT	4"	1/2"
D	8"	4	CONSTRUCTION UNDER THE SUPERVISION OF	1 1/12"	1/8"
E	2"	5	341 ST CONTRACTING & CIVIL ENGINEERING **	2 3/8"	1/4"
F	4"	6	GENERAL CONTRACTOR/ARCHITECT-ENGINEER	1 3/8"	3/16"
G	1"	7	* WILL VARY	1 3/8"	3/16"
H	2 7/8"		* WILL VARY		

U.S. AIR FORCE PROJECT DESIGN

NOT TO SCALE



NOTES:

1. Signboard 4' x 8' x 5/8" grade A-C exterior type plywood with medium density overlay on both sides.
2. Paint both sides and edges with one prime coat and two coats of paint in accordance with FED. STD. 595a, color number 37056 exterior type enamel. Lettering shall be as shown on drawing and shall be antique linen 33578 gloss exterior type enamel.
3. Lettering shall be Helvetica medium.
4. Acceptable abbreviations may be used for contractors name.
5. No company logo shall be used.
6. Sign posts and 1 1/2" wood trim shall be stained dark brown.
7. Upon completion of work under this contract, the project sign shall be removed from the job site and shall remain the property of the contractor.

Appendix 3

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01 00 10 - SECURITY

PART I - GENERAL

1.1 IDENTIFICATION OF EMPLOYEES

- 1.1.1. The Contractor shall furnish a list of employees needing access on base to the Base Contracting Officer. Employees without a badge and identification in their possession will be denied access to the base and work areas. An AF Form 75 will be issued to contractors working for thirty days or less. Contractors working for thirty days to one year will be issued an Identocard 2000 Contractor ID Card upon presentation of a properly completed AF Form 355 from the contracting officer or designated representative. Contractors working for more than one year will be issued a base decal upon presentation of a properly completed AF Form 355 from the contracting officer or designated representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CONDUCT OF WORK

- 3.1.1. Coordination and Access to Site: Coordination with using agencies shall be made through the Contracting Officer or designated representative to assist the Contractor in completing the work with a minimum of interference and inconvenience.
- 3.1.2. General Area Requirements: Security requirements and procedures shall be coordinated with the 341 Security Forces Squadron, Operations Section (extension 731-6416/4341), Malmstrom AFB. Activities of the Contractor and the Contractor's employees and subcontractors and their employees while on the base, will be in accordance with base regulations, including those of the fire marshall, as well as security directives. This includes, but is not limited to, giving way to all emergency vehicles that are in a response mode. All personnel performing duties as an escort official(s) for contractors within a restricted area are briefed thoroughly on control methods and actions to take to enforce control. Contractors will be briefed on security procedures and their responsibilities prior to the start of a contract. Contractors will be notified as necessary, to changes in security procedures.
- 3.1.2.1. Identification Credentials: All Contractor personnel, except those not under the Contractor's direct control, such as material deliveries, will be required to process in and obtain an Application for Civilian Identification Card (Air Force Form 355 or AF Form 1172) from the Malmstrom AFB Contracting Office in Building 145. After completion of the AF Form 355 or AF Form 1172, proceed to the Visitor Control Center in Bldg 192, open 0730-1630, to obtain identification badge. In addition, all private vehicles requiring access to the base will be required to display a vehicle sticker (AF Form 75) which may

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also be obtained in Bldg 192 after presentation of vehicle registration and certification of vehicle insurance coverage. The Contractor shall notify the 341 Security Forces Squadron, Operations Section, through the Contracting Officer, of any lost badges within 48 hours after the loss, by name, address, social security number, and badge number. Employees who have terminated employment or who have been dismissed must surrender their AF Form 75 Visitor/Vehicle Pass and Identocard 2000 Contractor ID Card to the Visitors Control Center through the Contracting Officer. Employees without a badge in their possession will be denied access to the base and work areas and may be subject to detainment until proper identification is made. The badge shall not be worn or displayed off the military base.

3.1.2.2. Commercial or company vehicles will be allowed access to the base provided company emblems are permanently attached to the sides of the vehicles. Magnetic signs are not acceptable. Personnel still require a badge or pass as identified in paragraph 1.

3.1.3. Restricted Area Requirements:

3.1.3.1. Scheduling of Work: The Contractor shall submit to the 341 Security Forces Squadron, Operation Section, through the Contracting Officer a work plan delineating work areas, work crews, and the size of each crew. The work areas will be definitive showing their relationship to roadways, adjacent structures, and the restricted area. The approved work plan shall be kept current. Construction shall be scheduled to proceed in a logical construction sequence and sufficient approved materials shall be on hand to complete entire segments of work as scheduled.

3.1.3.2. Escorts: Planning shall stress the need for a minimum number of escorts by localizing each segment of work. One Air Force escort shall accompany each work activity of six people or less, depending upon the task to be performed. The escorts will normally be available from 7:30 a.m. to 4 p.m., Monday through Friday. At the preconstruction conference, the Contractor shall be prepared to discuss the number of escorts they will require, and any work schedule change(s) proposals. When the work requires Contractor personnel to exit and reenter the area several times daily, they will be escorted between the work area and the Entry Control Point. Therefore, these activities shall be kept to a minimum.

3.1.3.3. Free Zone: No "Free Zone" will be established without a written request and the approval by the Installation Commander in concert with the Base Security Council. Free Zone Plans must be coordinated HQ AFSPC/SFO no later than 60 days before work starts. It must include an area map depicting the proposed free zone. Contractors must be under escort at all times while in the area.

3.1.3.4. Work Area Restrictions During Air Force Inspections, Exercises, and Investigations: Contractor personnel may be required to leave the area or stop working and relocate within the area during Air Force inspections and exercises. For certain Air Force actions, the Contractor will be prohibited from entering specified areas. If personnel are already in the restricted area, they may be allowed to relocate or may be required to exit the area entirely. (These actions can be expected to occur five (5) times for periods up to 1 hour per occurrence each week during the contract period). In addition, there is the possibility that for a single period of up to 10 working days during the contract the Contractor will be denied access to the Weapons Storage Area for a major Air Force Inspection. Notice of this exclusion period will be provided to the Contractor as soon as possible, but due to the nature of the inspection, this notification may be less than 48 hours in advance of the shutdown. During certain actual exercises and investigations, Contractor personnel will be under increased surveillance although they may not be working near the area affected.

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If the Contractor personnel are involved in the investigation, these personnel can continue with their work. Convoy movements of strategic Air Force resources may necessitate Contractor personnel being asked to relocate to an area sufficiently away from the convoy movement until convoy has safely passed.

- 3.1.3.5. Entry Authority List (EAL): EAL(s) will be prepared by the unit or agency responsible for monitoring or administrating the contract. The EAL(s) must be signed by the preparers unit commander or agency chief, and then forwarded to the Installation Commander or designated representative for final approval. Contractor vehicles must be listed on the EAL(s) including year, make, model, VIN, and license number as stated on registration. Privately Owned Vehicle(s) are not authorized within the Weapons Storage Area. The Contractor shall submit a list of personnel, including subcontractors, who will work within or adjacent to the restricted area(s). This list, which shall contain the name (Last, First and MI), address, Civilian Agency Affiliation, clearance information (If applicable), and social security number of each employee, no later than 1 week prior to initial start of work. This list shall be submitted on stationary with the company's letterhead and be signed by a responsible member of that company. After the list has been submitted, it will be the Contractor's responsibility to keep the list current. In addition to the 72-hour notification as noted below, not less than every 2 weeks, the Contractor shall submit a complete up-to-date list of persons desiring access to restricted area to include any additions or deletions made to the list during the preceding 2 weeks. The information listed above must be provided for new employees whose names were not listed on the initial list at least 72 hours prior to the time said new employees need access to the restricted areas. Employees who have terminated employment or who have been dismissed must be identified and removed as soon as possible from the entry authority list but no later than 24 hours after termination. Only those employees with base entry badges whose names are on the list will be permitted entry into the restricted area.
- 3.1.3.6. Entry Procedures: Contractor personnel will be subject to personal search and or transfrisk upon entering and leaving the WSA and will be escorted into the restricted area. Prior to entering and exiting the restricted area, Contractor personnel will be logged in and signed out on an Air Force Form at the entry control point by the escort official. The entry controller will check the employee's badge and one other form of photo identification against the prepositioned entry authority list prior to authorization of entry. Contractor personnel will be allowed access to the entrapment area on a first-come, first-serve, in-and-out basis with other personnel who may be requiring entry to or exit from the area. One exception to this is, emergency personnel responding (such as fire, ambulance and Security Forces) will be given priority entrance and exit at all times.
- 3.1.3.7. Vehicle search procedures will be in effect at all times upon entering and leaving the WSA. Each time a Contractor vehicle enters the vehicle entrapment area at the Weapons Storage Area, the vehicle will be searched by a Security Force member and observed by the escort official and escortee. Exterior bins and compartments shall be accessible for inspection. The entrapment area will accommodate one vehicle at a time. Primary emphasis of the searches will be placed on locating large obviously explosive devices, unusual objects, intruders, and other objects of suspicious nature. Contracting vehicles will be allowed access to the entrapment area on a first-come, first serve, in-and-out basis, with other vehicles requiring entry or exit from the area. The same two exceptions stated above apply.
- 3.1.3.8. Flame and Spark Producing Devices: The use of flame and spark producing devices within the Weapons Storage Area is discouraged. Flame and or spark producing equipment (i.e. Cutting torch, or similar devices) required to accomplish work will only be allowed after written approval from the Contracting Officer. The Contractor will give

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the base fire department 24-hour prior notification so that arrangements can be made to have a base fire truck standby during the period the device is in use. Smoking is permitted in designated area's only.

- 3.1.3.9. The work area, if practical, shall be fenced by the Government. Contractor personnel will be restricted to the project construction area within and adjacent to the restricted area. If fencing is erected, the fenced area cannot block access to other structures or hinder emergency or security forces.
- 3.1.3.10. Contractor shall not stockpile equipment within 30 feet of interior/exterior of a perimeter fence.
- 3.1.3.11. Existing lighting for security purposes must be functional at all times during the hours of darkness. Deficiencies in security lighting or power shall be repaired and replaced prior to the end of the workday.
- 3.1.3.12. Existing Power System: Power outages affecting intrusion detection system shall be requested in writing and approved a minimum of 48 hours in advance of the outage with the 341 Security Forces Squadron, Operations Section through the Contracting Officer.
- 3.1.3.13. Motorized Equipment:
 - 3.1.3.13.1. Unattended vehicles inside or within 100 feet of a restricted area shall be rendered immobile by removing the keys or by other suitable means.
- 3.1.3.14. Fire Extinguishers: Motorized equipment operated within the WSA shall be equipped with fire extinguishers as follows:
 - 3.1.3.14.1. Pickup truck or other light passenger vehicles: one extinguisher per vehicle, rating 5 BC.
 - 3.1.3.14.2. All other trucks and heavy motorized equipment: two extinguishers per vehicle, rating 10 BC.

END OF SECTION 01001

SECTION 01 78 04
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

This form 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 an 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.

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 Britich 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 LF from bldg entry to next larger size of pipe

- (a) Water (size & type of pipe, number of LF) _____
- (b) Gas (size & type of pipe, number of LF) _____
- (c) Sewer (size & type of pipe, number of LF) _____
- (d) Electric (phase, voltage, size & type of wire, connected load in amps) _____

(5) Air Conditioning:

- (a) Type _____
- (b) Capacity (TONS) _____
- (c) Sq Yds covered by systems _____

(6) Heating:

- (a) Source _____
- (b) Fuel _____

(7) Hot Water Facilities:

- (a) Capacity (GAL) _____
- (b) Temperature Rise _____

BUILDING COST: _____

5. BUILDING SYSTEMS (INTERIOR)

a. FIRE PROTECTION:

Property Code:

(880 50/880-211) CLOSED HEAD AUTO SPRINKLERS - SF & HD (wet or dry pipe; # of LF of service pipe; type of pipe & # of heads; # of SF covered by system)

DESCRIPTION: _____

COST: _____

(880 50/880-212) OPEN HEAD DELUGE SYSTEM - SF & HD (# of LF of service pipe; type of pipe; # of heads; # of SF covered)

DESCRIPTION: _____

COST: _____

(880 10/880-221) AUTO FIRE DETECTION SYSTEM - SF & EA (# of alarms-horns, bells, etc; # of smoke detectors; # of heat detectors; # of fire alarm panels; # of radio transmitters/antennae)

DESCRIPTION: _____

COST: _____

(880 20/880-222) MANUAL FIRE ALARM SYSTEM - EA (# of pull stations; # of alarm horns; # of fire extinguisher cabinets)

DESCRIPTION: _____

COST: _____

(880 60/880-231) CO2 FIRE SYSTEM (# of bottles & size of bottles in lbs)

DESCRIPTION: _____

COST: _____

(880 60/880-232) FOAM FIRE SYSTEM - EA (# of tanks - capacity in lbs)

DESCRIPTION: _____

COST: _____
(880 60/880-233) OTHER FIRE SYSTEM - EA
DESCRIPTION: _____

COST: _____
(880-60-880-234) HALON 1301 FIRE SYSTEM - EA (# of bottles & size of bottles in lbs)
DESCRIPTION: _____

COST: _____

b. SECURITY

(880 40/872-841) SECURITY ALARM SYSTEM - EA (name of system installed)
DESCRIPTION: _____

COST: _____

c. HEATING/COOLING SYSTEMS

(826 10/890-126) A/C WINDOW UNITS - TN & SF (# of units installed; amount of SF covered per unit; size & capacity of each unit)
DESCRIPTION: _____

COST: _____

(826 14/890-125) A/C PLT LESS THAN 5 TN - TN & SF (# of TN; # of SF covered)
DESCRIPTION: _____

COST: _____

(826 13/890-121) A/C PLT 5 TO 25 TN - TN (# of TN; # of SF covered)
DESCRIPTION: _____

COST: _____

(826 12/826-122) A/C PLT 25 TO 100 TN - TN (# of TN; # of SF covered)
DESCRIPTION: _____

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COST: _____

(826 11/826-123) A/C PLT OVER 100 TN - TN (# of TN; # of SF covered)

DESCRIPTION: _____

COST: _____

(821 33/821-115) HEATING PLT 750/3500 MB - MB (# of MBH; type of heating system
- Ex: Warm air furnace, central)

DESCRIPTION: _____

COST: _____

(821 32/821-116) HEATING PLT OVER 3500 MB - MB (# of MBH; type of heating
system)

DESCRIPTION: _____

COST: _____

(811 60/811-147) ELEC EMERGENCY POWER GENERATOR-KW (size of engine;
rating of generator in kilowatts & voltage)

DESCRIPTION: _____

COST: _____

(81190 or 82320-gas) STORAGE TANK FOR HEATING or GENERATOR FUEL - GA;
TYPE; FUEL - (size, type of tank, kind of fuel & # of gallons)

DESCRIPTION: _____

COST: _____

SITE WORK

6. UTILITIES/SURFACE CONSTRUCTION

(1) (812 41/812-223) PRIM DISTR LINE OH-LF (# LF of wire; size & type of wire; # of
poles, voltage)

DESCRIPTION: _____

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COST: _____

(2) (812/81360) TRANSFORMERS - KVA POWER POLES - LF
(# poles, # transformers - pad or pole mounted; KVA of wire; # LF of wire)
DESCRIPTION: _____

COST: _____

(3) (812 40/812-224) SEC DISTR LINE OH-LF (voltage; size & type of wire: #
transformers; KVA; # LF of wire; # of service drops; # poles)
DESCRIPTION: _____

COST: _____

(4) (812 42/812-225) PRIM DISTR LINE UG-LF (KVA; voltage; type of conduit & size
(encased or direct burial); size & kind of wire inside conduit; LF of wire & conduit)
DESCRIPTION: _____

COST: _____

(5) (812 42/812-226) SEC DISTR LINE UG-LF - (type of conduit & size; type & size of
wires in conduit; LF 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; # LF of connecting wire if pole mounted)
DESCRIPTION: _____

COST: _____

(7) (824 10/824-464) GAS MAINS - LF (size, type & # of LF of pipe)
DESCRIPTION: _____

COST: _____

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(8) (831 90/831-169) SEWAGE SEPTIC TANK - KG - (size, kind of material & capacity)

COST: _____

(9) (832 10/832-266) SANITGARY SEWER - LF - (sizes & types of pipes - # of LF of each, # of cleanouts; # of size of manholes)

COST: _____

(10) (842 10/842-245) WATER DISTR MAINS (POTABLE) - LF - (# LF & size, type of pipe)

COST: _____

(11) (843 11/843-315) (FIRE HYDRANTS - EA - (#; size & type)

COST: _____

(12) (851 90/851-143) CURBS & GUTTERS - LF - (#LF; material; width & height)

COST: _____

(13) (851 90/851-145) DRIVEWAY - SV - (SY; material used; thickness)

COST: _____

(14) (851 10/12/851-147) ORAD-SY & LF - (SY; material used; thickness; LF)

COST: _____

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(15) 852 10/11/852-262) VEHICLE PARKING - SY (SY; material used; thickness; # of bollards; # of wheel stops; # of regular parking spaces; # of handicap spaces)

COST: _____

(16) (852 20/852-289) SIDEWALKS - SY & LF - (# SF & LF; dimensions of each section & location; thickness; material used)

COST: _____

(17) (871 10/871-183) STORM DRAIN DISPOSAL - LF - (# LF of pipe; sizes & types of pipe; # of catch basins & manholes & sizes of each)

COST: _____

(18) (872 15/872-247) FENCE, SECURITY (ARMS) - LF - (# of LF; fence material; # of type of gates; # strands of barbed wire on top)

COST: _____

(19) (872 10/12/872-248) FENCE, INTERIOR - LF (# of LF; fence material; # of kind of gates)

COST: _____

(20) (890 70/890-187) UTILITY VAULT (4 or more transformers) - SF (# SF; dimensions of vault; # of xfmers)

COST: _____

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(21) (135 10/135-583) TEL DUCT FACILITY - LF - (# of LF; size & type of conduit; type of wire)

COST: _____

(22) (135 10/135-586) TEL POLE FACILITY - LF (# LF & type of wire; # of poles)

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 systems. 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 LF of asbestos removed, number of LF of re-insulation, number of SF 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.

Irrigation System - (LF of pipe, size & type of pipe; number and type of heads)
Underground/Aboveground Storage Tanks - (GA, type of tank; material used)
(833-354) Dumpster Enclosure - (SF and dimensions)
(890-152) Unloading Pad - (SY; material)
Signage - (dimensions; materials)
(12580) Cathodic Protection - (MI; LF)
(87270) Lightning Protection - (LF)
(81290) Pole Duct Riser - (LF, type of material)
Ramps - (SF, material; CY if concrete-use code for sidewalk if concrete)
(890 80/890-158) Load and Unload Platform - (SF)
(832 40/832-255) Industrial Waste Main - (LF)
Wheel Stops - (EA; size & material)
(81350) Outdoor Integral Distr Ctr - (KVA)
(45110) Outdoor Storage Area - (SF)
(730 55/730-275) Bus/Wait Shelter - (SF)
(690-432) Flagpole - (EA; dimensions)
(932 10) Site Improvement - (JOB)
(932 20) Landscape Planting (Acre; EA; SF)
(932 30) Landscape Berms/Mounds - (SY)
(934 10) Cut and Fill - (CY)
(843-315) Fire Hydrants - (EA; type)
(149 70) Loading and Unloading Docks and Ramps (not connected to a bldg) (SF)
Bicycle Rack - (EA)
(85140/812-928) Traffic Signals - (EA)
(872 10) Fencing or Walls - (LF)
(154 32) riprap - (LF & SY)
(750 61) Grandstand or Bleachers - (EA; SE)
871 50/8710187) Retaining Walls - (LF; SY; material)

NOTE: 5 Digit Codes - Army; 6 Digit Codes - Air Force

END OF SECTION

SECTION 01 78 05
EQUIPMENT IN PLACE LIST

PART 1. GENERAL

1.1 SUBMITTALS

Data listed in Part 3 of this section shall be submitted in accordance with Section 01300, Submittals. 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-in-place list shall be completed and returned to the contracting officer within 30 calendar days of the final inspection. The contracting officer will review all final equipment-in-place 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. EQUIPMENT-IN-PLACE LIST:

Contractor shall submit for approval, at the completion of construction, a list of equipment in place. 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 equipment-in-place list shall be comprised of all equipment falling under one or more of the following classifications:

- Each piece of equipment listed on the mechanical equipment schedules
- Each electrical panel, switchboard, and MCC panel
- Each transformer
- Each piece of equipment or furniture designed to be movable
- Each piece of equipment that contains a manufacturer's serial number on the name plate
- All government furnished, contractor-installed equipment per a through e (price data excluded)

Appendix 5

The equipment listed above shall be entered in the RMS CQC module furnished by the government under the "installed property" menu selection.

3.3 PAYMENT:

All costs incurred by the contractor in the preparation and furnishings of equipment-in-place lists shall be included in the contract price and no separate payment will be made for this work. Approval and acceptance of the final equipment-in-place lists shall be accomplished before final payment is made to the contractor.

3.4. RMS CQC SOFTWARE MODULE

The contractor is required to use the RMS CQC software module to manage the above required equipment-in-place data. See specification section 01400, Contractor Quality Control, paragraph 3.12, Implementation of Government Resident Management System for Contractor Quality Control of Contract.

EQUIPMENT-IN-PLACE LIST

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 Address _____

Telephone Number: _____

WARRANTY PERIOD: _____

Checked By: _____

Section Reserved

Appendix 5



DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, DC 20301-1010

October 31, 2008

MEMORANDUM FOR:

SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDERSECRETARIES OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
DIRECTOR, OPERATIONAL TEST AND EVALUATION
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
ASSISTANTS TO THE SECRETARY OF DEFENSE
DIRECTOR, ADMINISTRATION AND MANAGEMENT
DIRECTOR, PROGRAM ANALYSIS AND EVALUATION
DIRECTOR, NET ASSESSMENT
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Access for People with Disabilities

It is the goal of the Department of Defense (DoD) to make its facilities accessible to persons with disabilities. To achieve that goal, the Department intends to go beyond the minimum requirements of law. Even if a facility is exempt from coverage under the Architectural Barriers Act of 1968 (ABA), compliance with the standards identified in this memorandum is recommended to the maximum extent that is reasonable and practicable without degrading the facility's military utility.

This memorandum updates DoD standards for making facilities accessible to people with disabilities. DoD is one of four Federal agencies that issue standards under the ABA. The Department also establishes accessibility requirements under Section 504 of the Rehabilitation Act of 1973, as amended. Currently, as a matter of policy, the more stringent of either the *Uniform Federal Accessibility Standards* (49 FR 31528) or the 1991 version of the *Americans with Disabilities Act Accessibility Guidelines* is in effect within DoD and for recipients of DoD financial assistance.

The United States Access Board has issued an update of the ABA and Americans with Disabilities Act (ADA) guidelines as a single rule published at Part 1191 of title 36, Code of Federal Regulations, which contains scoping provisions specifying what must be accessible and technical requirements specifying how access is to be achieved. The rule is divided into three parts: a scoping document for ABA facilities (ABA Chapters 1 and 2), a scoping document for ADA facilities (ADA Chapters 1 and 2), and a common set of technical criteria referenced by both scoping documents (Chapters 3 through 10).

DoD hereby adopts ABA Chapters 1 and 2 and Chapters 3 through 10 as its standards (the "DoD standards") under the ABA and also under Section 504 of the Rehabilitation Act. Subject to the special provisions specified in the attachment provided on DoD facilities, which is also part of the DoD standards, you are directed to meet the requirements of ABA Chapters 1 and 2 and Chapters 3 through 10, and to require recipients of financial assistance from your organization to do the same. Such recipients include only those private sector programs and activities covered by Section 504 of the Rehabilitation Act. Most DoD contractors are not covered but will likely be subject to the Americans with Disabilities Act.

The Secretary of Defense Memorandum dated October 20, 1993, *Access for People with Disabilities*, is hereby rescinded.

Any questions may be directed to Mr. Clarence A. Johnson at (703) 571-9321.

Attachment:
Access for People With Disabilities

Access for People with Disabilities

Appendix 5

1. GENERAL. This attachment describes the manner in which facilities designed, constructed (including additions), altered, leased, or funded by the Department of Defense (DoD) are to be made accessible to people with disabilities in accordance with the Architectural Barriers Act of 1968 (ABA), as amended, 42 U.S.C. § 4151, *et seq.*, and Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794.

On July 23, 2004, the United States Access Board issued updated accessibility guidelines for newly constructed, altered, and leased facilities covered by the ABA and Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. § 12101, *et seq.* These guidelines were published in the *Federal Register* on July 23, 2004 (69 FR 44083), and are online at <http://www.access-board.gov/>. **1**

Requirements for new construction, alterations, and leased facilities vary and are specified in these new **DoD Standards**. In general, worldwide, all facilities designed, constructed, altered, leased, or funded by DoD that are open to the public, or to limited segments of the public, or that may be visited by the public, or by limited segments of the public, in the conduct of normal business, shall be designed and constructed to be accessible to persons with disabilities. The types of facilities to which these DoD Standards apply include, but are not limited to, the following:

- (a) All housing, including military family housing and unaccompanied personnel housing. **2**
- (b) All morale, welfare, and recreation facilities, including non-appropriated fund facilities available to dependents or retirees.
- (c) All hospitals and facilities for the care or rehabilitation of persons who are sick or injured.
- (d) All relocatable facilities, including those acquired as "personal property." Relocatable facilities, including those acquired as "personal property," shall be evaluated, for purposes of applying these DoD Standards, as though they are permanent facilities.
- (e) All manufacturing facilities, administrative facilities, educational facilities, and any other facilities where civilian workers may be employed, including facilities constructed under other than military construction authorizations and including contractor-owned facilities where DoD is funding all or part of the construction.

The Department of Defense shall require as part of the joint venture agreement in all public-private ventures which include facilities, including privatized housing, that those facilities be designed and constructed in accordance with these DoD Standards.

In addition to these DoD Standards, facilities of all types shall comply with any applicable provision of law and regulation which may include the following:

- i. The Fair Housing Amendments of 1988, 42 U.S.C. §§ 3601-3620, which prohibit discrimination on the basis of disability in multi-family housing, including military family housing, and require elimination of architectural barriers in common areas and construction of accessible units on a percentage basis.
- ii. The Americans with Disabilities Act of 1990, 42 U.S.C. § 12101, *et seq.*, which prohibits discrimination in, among other things, public accommodations and commercial facilities and may apply to some entities that occupy space on DoD property or are housed in DoD or DoD-funded facilities. Entities that might be covered include State and local governments, banks, childcare centers, and fast food stores. In addition, standards for nondiscrimination in employment under this Act apply to Federal employment under Section 501 of the Rehabilitation Act. This includes standards for elimination of architectural barriers.
- iii. Section 501 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 791(b), and implementing regulations at 29 CFR 1614.203, which prohibit discrimination in Federal civilian employment against a qualified person with a disability and require elimination of architectural barriers for employees and applicants with disabilities.

2. PRIMARY FUNCTION AREAS. Requirements for alterations (Section F202.4 of ABA Chapter 2) and leased facilities (Section F202.6.2 of ABA Chapter 2) refer to "primary function areas." DoD defines a primary function area as an area that contains a major activity for which the facility is intended. This includes areas in which a DoD entity or a recipient of DoD financial assistance provides services to the public or limited segments of the public, as well as offices and other work areas in which the activities of a DoD entity or a recipient of DoD financial assistance are carried out.

In accordance with Section F202.4 of ABA Chapter 2, an alteration that affects or could affect the usability of or access to an area containing a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the altered area, including the rest rooms, telephones, and drinking fountains serving the altered area, is readily accessible to and usable by individuals with disabilities, unless such alterations would increase the cost and scope of the overall alteration by more than twenty percent. If the costs of providing an accessible path of travel to the altered area would increase the cost and scope of the overall alteration by more than twenty percent, the path of travel shall be made accessible to the extent possible at least up to that twenty percent increase. **3** Priority should be given to those elements that will provide the greatest access in the following order:

- (a) An accessible route and accessible entrance to connect the altered area and site arrival points;
- (b) An accessible restroom for each sex or a single unisex restroom;

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(c) Accessible telephones;

(d) Accessible drinking fountains; and

(e) Accessible parking spaces.

In facility planning, if a series of alterations will be made to areas containing a primary function, and those alterations together will not provide an accessible path of travel to the altered areas, the total costs of the alterations planned within the three-year period after the initial alteration shall be considered when determining obligations to provide an accessible path of travel in accordance with this paragraph.

3. EXCLUSIONS. The following facilities need not comply with these DoD Standards:

(a) Facilities, or portions of facilities, on a military installation⁴ that are designed and constructed for use exclusively by able-bodied military personnel.

(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively by able-bodied military personnel.

(c) Facilities obtained in emergencies such as natural disasters or in an area where contingency operations are being conducted.

Nevertheless, since the intended use of such excluded facilities may change with time or in emergencies, compliance with these DoD Standards is recommended to the maximum extent that is reasonable and practicable without degrading the facility's military utility.

4. FACILITIES IN OTHER COUNTRIES. Facilities in other countries for which the United States contributes a portion of the construction cost but does not control design criteria (such as NATO-funded facilities) need not comply with these standards, but accessibility is recommended if obtainable. Facilities being constructed by or for use by the United States under the laws, codes, rules, and regulations of a host nation need not be accessible pursuant to U.S. law, but may need to comply with similar requirements of the host nation, as applicable international agreements provide. Likewise, facilities leased by the United States in other countries need not be accessible pursuant to U.S. law, but may need to comply with similar requirements of the host nation, as applicable international agreements provide. Nevertheless, in order to avoid applying different and lesser standards to DoD facilities located outside the United States, compliance with these DoD Standards should be sought in all instances to the fullest extent that is reasonable and practicable without degrading the facility's military utility.

5. WAIVERS. Any other deviation from these DoD Standards shall be made only through the waiver or modification process. Requests for waivers or modifications are to be forwarded through the chain of command for approval by the Principal Deputy Under Secretary of Defense (personnel and Readiness), who represents DoD on the United States Access Board. Waivers and modifications will be considered on a case-by-case basis and granted only if the waiver or modification is clearly necessary.

6. DOCUMENTATION. DoD Component Heads shall ensure that each contract, grant, or loan for the design, construction, or alteration of a facility subject to these DoD Standards and each lease for a facility subject to these DoD Standards:

(a) Incorporates these DoD Standards in the specifications for the design, construction, or alteration of the facility;

(b) Specifies that any leased facility meets these DoD Standards, or has been or will be altered to meet these Standards; or

(c) Includes a statement that these DoD Standards have been waived or modified by the Principal Deputy Under Secretary of Defense (Personnel and Readiness), as specified in an attached copy of the waiver or modification.

In addition, if a determination is made that a facility is not subject to these DoD Standards, the DoD Component Head must ensure that documentation is maintained to justify the determination.

7. APPLICABILITY. The provisions of this memorandum apply to the Office of the Secretary of Defense, the Military Departments (including their Reserve components), the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities in the Department of Defense.

These new DoD Standards are effective immediately. All projects in or after Fiscal Year 2010, regardless of the source of funds, must be programmed, designed, and constructed to comply with these DoD Standards. All projects before Fiscal Year 2010, regardless of the source of funds, must comply with these DoD Standards to the maximum extent feasible.

These DoD Standards shall apply to all leases for which a solicitation, including any sole source solicitation, is issued after the date of this memorandum. These standards shall also apply to existing leases, which shall be brought into compliance within five years

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of the date of this memorandum or upon extension or renewal of a lease after the date of this memorandum (whichever comes first), treating the extension, renewal, or existing lease as though it were a new lease.

1 As published in the *Federal Register* and the *Code of Federal Regulations*, the Board's final rule consists of five Appendices (not three parts): Appendix A is the Table of Contents; Appendix B is ADA Chapters 1 and 2 (scoping requirements); Appendix C is ABA Chapters 1 and 2 (scoping requirements); Appendix D is Chapters 3 through 10 (common technical requirements); and Appendix E is the List of Figures and Index. On the Board's website, the final rule is organized by Chapters instead of Appendices.

2 See definition of "residential dwelling unit" at section FI06.4 of ABA Chapter 1.

3 A DoD Component may choose to expend funds beyond twenty percent but is not required to do so by these DoD Standards.

4 As defined in Section 2910(4) of the Defense Base Closure and Realignment Act of 1990.

DIVISION 32 - SITE WORK
SECTION 32 92 12
SEEDING, SODDING AND FERTILIZING

1. GENERAL.

The work described in this section shall consist of providing all labor, services, fertilizer, sod, seed and equipment to establish grasses per these specifications. The Contractor shall return site to grass and maintain until lawn is established.

The Contractor shall be or shall employ an expert plantsman who will be present during all seeding and sodding operations and direct the work. All vegetation must meet or exceed the cold hardiness rating for USDA hardiness zone 3a (-35 to -30F).

All areas designated on the drawings and/or disturbed prior to and during construction shall be seeded to grass except for existing lawn areas, which shall be sodded. The Contractor may strip existing sod prior to excavation and utilize it to sod the area or furnish new sod.

2. APPLICABLE PUBLICATIONS.

2.1 American Sod Producers Association.

Guideline Specifications to Sodding

3. MATERIAL.

3.1 Existing Sod. Existing sod may be carefully stripped in strips not to exceed 3 feet in length and one foot in width and shall have a soil thickness of approximately 1 inch. The sod shall be carefully cut along straight lines. Sod shall be stored on pallets and kept moist and green until ready for installation. Sod that is torn or irregularly shaped or that is allowed to wither, dry out, mold, or mildew shall be discarded and removed.

3.2 Sod. All sod shall be Grade A Kentucky Bluegrass sod and contain approximately equal proportions of Glade, Adelphi, Midnight, and Limonsune. Certification of composition must be provided by the sod supplier. The sod shall contain absolutely no noxious weeds and less than five plant per acre broadleaf weeds.

3.3 Grass Seed. Grass seed will be provided by the Contractor. All grass seed shall be certified free from noxious weeds, re-cleaned, Grade A recent crop seed. It shall be treated with appropriate fungicide and delivered to the site in sealed containers with dealer's guaranteed analysis. All seed shall be properly stored by the Contractor and any seed damaged during such storage shall be replaced by the Contractor at his expense.

The seed mixture will depend on the specified type of area to be seeded. All seed should be the selected varieties, or alternative equal varieties accepted in advance by the Government. The specified varieties establish the grass performance characteristics desired. Requests for approval as an equal shall furnish all information necessary for the Contracting Officer to make a determination whether or not the requested substitution is equal to or better than the specified variety in all respects. The Contractor shall submit certifications to the Contracting Officer for approval.

3.3.1 Lawn Grass Mixture for Type 1 landscape

<u>Plant Cultivar & Species</u>	<u>Proportion by Weight in Mixture</u>	<u>% Purity</u>	<u>% Germination</u>
Daytona Fine Leaf Perennial Rye	20%	98%	90%
NuBlue Kentucky Bluegrass	20%	98%	90%
Blue Chip Kentucky Bluegrass	20%	98%	90%
Common Kentucky Bluegrass	20%	98%	90%
Pennlawn Creeping Red Fescue	20%	98%	90%

3.3.2 Lawn Grass Mixture for Type 2 Landscape Lawns and Type 3 Irrigated Lawns

<u>Plant Cultivar & Species</u>	<u>Proportion by Weight in Mixture</u>	<u>% Purity</u>	<u>% Germination</u>
Common Kentucky Bluegrass	20%	98%	90%
Pixie Turf Type Tall Fescue	80%	98%	90%

3.3.3 Lawn Grass Mixture for Type 3 Non-Irrigated Lawns

<u>Plant Cultivar & Species</u>	<u>Proportion by PLS Count</u>
Brigade Hard Fescue	50%
Ephraim Crested Wheatgrass	30%
MX86 Sheep Fescue	20%

3.3.4 Native Grass Mixture for Unimproved, Non-Irrigated Natural Areas

<u>Plant Cultivar & Species</u>	<u>Proportion by PLS Count</u>	<u>% of Mixture</u>	<u>Pounds per Acre in Mixture</u>
Lodorm green needlegrass	5	50%	2.5
Rosanna western wheatgrass	8	25%	2.4
Pryor slender wheatgrass	6	15%	0.9
Appar lewis blue flax	3	10%	0.2

Seed shall comply with and be labeled in accordance with current Federal and Montana seed quality criteria. Seed shall be certified weed free and have been grown in the North American Continent above 47° latitude. All seed shall be standard grade adapted to Montana conditions.

3.3.5 Source Quality Control: Seed materials shall be subject to inspection and acceptance. Contracting Officer reserves right to reject at any time or place prior to acceptance of work, seed which in Contracting Officer’s opinion fails to meet these specification requirements. Inspection is primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance. Inspection shall be made periodically during seeding, at completion, and at end of warranty period.

3.3.6 Testing Requirements: Seed and seed label shall conform to current State and Federal regulations and subject to testing provisions of Association of Official Seed Analysis.

3.4 Topsoil. Topsoil from existing stripped material or from off-site. Off-site material shall have compost added to the topsoil during new construction or landscape enhancement. Topsoil shall be obtained from well-drained areas and shall be free of any foreign matter, toxic substances, and any material or substances that may be harmful to plant growth. Topsoil shall be tested by an independent soil lab and if required, amended or processed to conform to the following requirement.

Topsoil Specifications Adding 1 Yard of Compost per 1000 square feet

<u>Characteristic</u>	<u>Optimum</u>	<u>Minimum</u>	<u>Maximum</u>
pH	6.5	5.5	8.3
Nitrate (#/ac)	50	1	300
Organic Matter (%)	2 to 3	0.5	5
Phosphorus (Olsen, ug/g)	40	2	150
Potassium (ug/g)	500	100	1000

Sodium (meq/100g)	< .5	n/a	2.5
Calcium (meq/100g)	> 5.0	0.5	20
Sulfate as S (ug/g)	20 to 100	3	1000
Conductivity (mmhos / cm)	< 0.5	n/a	2.5
Lime (qualitative)	Slight	None	Medium

The Contractor shall furnish off-site topsoil and amendments.

3.5 Fertilizer. Fertilizer shall only be used in the improved portions of base that receive daily irrigation. On seeded areas the fertilizer shall be spread 12-months after seeding or as soon as the grass has become established, whichever is sooner. On sodded areas the fertilizer shall be spread just prior to laying the sod. Fertilizer shall be 10-40-10 and be furnished by the Contractor and shall be applied to selected areas at a rate of 400 pounds per acre.

Fertilizer to be spread on areas to be seeded should be commercially prepared, complete, uniform in composition, dry and free flowing. The fertilizer should be delivered to the site in the original waterproof containers, each bearing the manufacturer's statement of analysis. If stored at the site, protect fertilizer from the elements at all times.

Fertilizer to be spread on sodded areas shall meet the same specifications but shall be spread on the prepared surface, underneath the sod and just prior to laying the sod on top of the prepared surface.

The Contracting Officer reserves the right to request the contractor to obtain independent tests of the material at any time and to accept or reject the material based on these tests.

If the fertilizer is not used immediately, the Contractor shall store the unused material in such a manner that its usefulness will not be impaired.

3.6 Fiber Mulch Fiber mulch should be applied to all seeding areas (Type 1 to 3 and Unimproved Areas) where feasible. Uniformly apply mulch after seeding. **Mulch material will be certified weed free.** The fiber mulch shall be an organic wood cellulose fiber mulch.

Wood cellulose fiber or paper mulch may be applied by hydraulic equipment with water as the carrying agent. Continuous agitation of the mulch will be maintained to provide uniform suspension and distribution of the material. Application on slopes should work downward from the top to the toe of the slope. Application rate should be 2,000 pounds/acre

Commercially available tackifiers can be used as mulch binders. Application should be evenly distributed over the revegetation site. Refer to manufactures product guidelines for recommended uses, application methods and rates.

4. CONSTRUCTION.

4.1 Sodding. The area to be sodded shall be covered with 6 inches of lightly compacted topsoil as specified in the Section: Site Grading and Excavation. The topsoil shall be graded smooth and uniform and so that the newly sodded surface will blend smoothly with existing turf. Fertilizer shall be placed on the prepared surface. The sod shall be placed on top of the fertilizer and watered as recommended by the sod supplier, in conformance with "Guideline Specifications to Sodding", or a minimum of once per day, whichever provides more moisture. All sod shall be placed with each segment tightly butted to adjacent sections and to existing turf. There shall be no holes, discontinuities, or ridges in the finished surface. The Contractor shall maintain the sod to include watering and two grass cuttings. The initial grass cutting shall commence when the sod reaches 4 inches in height. At this time it will be cut back to two inches. The second cutting will be at a height of 3 1/2 to 4 inches. An inspection will be held after the second cutting. If the sod fails to grow and dies, the sod shall be replaced by the Contractor at no additional cost to the Government. All irrigated lawn areas disturbed by construction shall be sodded.

4.1.1 Fertilizing Sod. The Contractor shall fertilize the prepared surface just prior to laying the sod. Both nitrogen and phosphate shall be applied at rates of 0.5 pounds per 100 square feet of sodded surface or as recommended by a reputable commercial sod supplier.

4.2 Seeding. The amount of area to be seeded shall be based on shaded area of drawings. All other areas disturbed during construction shall be the responsibility of the Contractor.

4.2.1 Time of Seeding. Seeding should primarily occur between October 15 and May 15. Warm season grasses should be planted in the summer with adequate watering. The seed shall not be drilled or sown during windy weather, snow is on the ground, or when ground is otherwise untillable. Seeding in questionable conditions must be approved by the Contracting Officer.

4.2.2 Preparation of Seedbed. Seed bed preparation should not commence until the moisture conditions make the ground area and soil friable. The ground should be hand or machine raked so as to remove all debris, clods, rocks, and other material larger than 1 inch, to a depth 2 inches. Such debris, clods, rocks, and other material so removed should be disposed of off the base at the contractor's expense. Grade lawn areas to finish grades, filling as needed or removing surplus earth and floating areas to a smooth uniform grade. All lawn areas should slope to drain. Where no grades are shown, surfaces should have a smooth and continual grade between existing or fixed controls such as walks, curbs, catch basins, elevations at steps or buildings. Roll, scarify, rake, and level as necessary to obtain true even lawn surfaces. All finish grades must have approval of the contracting officer before seed is sown.

4.2.3 Fertilizing Seeded Grass. Grass species do not utilize fertilizer very effectively in the first year. Fertilizer should only be applied at the time of seeding on sites with poor fertility or granitic soils (**determined by a soil test**). Fertilizer, 10-40-10, shall be applied to seeded areas at a rate of 400 pounds per acre. A time released fertilizer may have benefits depending on site conditions.

4.2.5 Seeding Turf (Type 1 to 3) Grass. Soil that is too loose or dry for good handling must be moistened and lightly rolled before seeding. Small grass, forbs, and legume seeds shall be planted no deeper than ½ inch. Large grass seeds shall be planted no deeper than 1 inch. Seed shall be sown at the rate of 5 pounds of lawn grass mixture for Type 1 landscape lawns per 1,000 square feet, or 7 pounds of lawn grass mixture for Type 2 landscape lawns and Type 3 irrigated lawns per 1,000 square feet, or 2.5 pounds of lawn grass mixture for Type 3 landscape non-irrigated lawns per 1,000 square feet. Seed should be sown exercising great care that a uniform distribution of seed is obtained. Seeding should be done on a still day, using a drill seeder. On slopes too steep to drill a hopper type broadcast spreader may be used as long as the seed is raked and covered afterwards.

4.2.6 Seeding Native Grass in Unimproved Areas. Seeding in unimproved areas is restricted by moisture conditions and therefore shall only be planted between October 15 and May 15. Those portions of the unimproved areas with irrigation available (i.e., a nearby fire hydrant) may be seeded at any time of the year with either a drill seeder or hydro-seed as long as the watering requirements can be strictly adhered to. Small grass, forbs, and legume seeds shall be planted no deeper than ½ inch. Large grass seeds shall be planted no deeper than 1 inch. Seed shall be sown at the seed mixture and rate shown in paragraph 3.3.4. Seed should be sown exercising great care that a uniform distribution of seed is obtained. Seeding should be done on a still day, using a drill seeder. On slopes too steep to drill, a hopper type broadcast spreader may be used as long as the seed is raked and covered afterwards.

4.2.7 Hand Seeding. Hand seeding or mechanical seeding of narrow medians or small areas is permissible as long as soil preparation, mulching, and all other requirements are met.

4.3 Establishment.

4.3.1 General. The Contractor shall be responsible for seeding and growth.

4.3.2. Water. Water may be available from an existing Malmstrom source. The Contractor is responsible to supply water required to establish stand of grass either from the Malmstrom source or his own source. The Contractor shall provide portable watering equipment when needed.

Adequate moisture must be available at all times during the pre-sprout phase and the top 1 inch of soil should stay moist at all times. The germination time for grass seed ranges from 5 to 30 days depending on the variety. It can be even longer than this in cooler temperatures. Newly seeded areas will be watered at least twice per day but the overall frequency and duration of watering shall be determined on-site by the Contractor based on soil conditions, temperature, and weather. For Type 1, 2 and 3 irrigated and non-irrigated lawns, watering will be reduced to once a day when the grass reaches a height of 4 inches. After the second cutting the grass shall be considered established and special watering regimes may cease.

Unimproved areas with available irrigation may be hydro-seeded as long as watering requirements can be adhered to. Regardless of seeding mechanism, the top 1 inch of soil should stay moist at all times and be watered at least twice per day, but the overall frequency and duration of watering shall be determined on-site by the Contractor based on soil conditions, temperature, and weather. When the grass reaches a height of 4 inches it shall be considered established and special watering regimes may cease.

Contractors will avoid:

- over watering that results in puddles on the surface
- runoff and seed movement on sloping ground
- over watering that allows the soil to get soggy and spongy
- overwatering areas that are shaded
- uneven watering due to sprinklers that are clogged, not adjusted or inadequately designed
- under watering new grass seed, especially not often enough due to any and all reasons

4.3.3 Cutting. The initial grass cutting shall commence in Type 1 to 3 lawns when the new grass reaches a height of 4 inches. At this time the new grass will be cut back to 3 inches. A final inspection will be held after the 2nd cutting. Reseed and water areas in which no stand of grass is established.

4.3.4 Reseeding. Bare spots exceeding 16 square inches will require reseeding. Reseeding shall be completed only in such period as may be allowed by the Contracting Officer. Reseeding shall be with the same seed types, mixture and method as originally used and shall be applied at the rate specified for the original seeding in a manner that will cause a minimum of disturbance of the existing stand of grass. Reseeding shall be accomplished at no additional cost to the Government. Seed for reseeding will be supplied by the Contractor.

4.4 Repair. If at any time before completion and acceptance of the entire work covered by this contract, any portion of the surface becomes gullied or otherwise damaged following seeding the affected portion shall be repaired to re-establish the condition and grade of the soil prior to seeding and shall then be reseeded as specified above, at the Contractor's expense.

If sod or seeded grass fails to grow or dies, the affected portion shall be removed and the area repaired and resodded or seeded, as appropriate, by the Contractor at no additional expense to the Government. The Contractor shall be responsible for maintaining the grass and sod until it is successfully established.

END OF DOCUMENT

LANDSCAPE PLANTING PALETTE CHARTS

General Plan Supplement

MALMSTROM AIR FORCE BASE



Prepared By:
341st Civil Engineer Squadron
Asset Management Flight
Conservation Program
Malmstrom Air Force Base
Great Falls, Montana 59402

February, 2012

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 Seeding, Sodding, and Fertilizing Specification

See Landscape Planting Palette, FY 2012 for the entire document

INTRODUCTION:

This document was developed to provide a list of recommended native and non-native vegetation to be planted to achieve facilities excellence in accordance with with previous documents, such as The Facilities Excellence Plan and MAFB General Plan. The species provided in this supplement are either native to Montana or are considered ornamental (non-invasive) and able to survive in USDA Hardiness Zone 4 or colder.

A plant's ability to survive is dependent upon the plant's hardiness in relation to local climatic and specific site conditions; therefore, factors such as soils, temperature, moisture and light should be considered when selecting plant species. This palette is designed to help the designer choose the best plant for each particular set of design requirements.

Additionally, Malmstrom's landscape is divided into different types: Landscape, Landscape lawns, Irrigated lawns, Non-irrigated lawns, and Unimproved non-irrigated natural areas. Landscape type must be considered when developing a landscape design.

This palette is organized into sections depending upon vegetation type: grasses, ornamental grasses, vines, groundcover, shrubs, trees, and wildflowers. The beginning includes a chart with information such as light and moisture requirements for each species. Additional information is located in the corresponding sections.

The plants that appear on the following lists were selected for their ability to survive the climatic conditions found at Malmstrom Air Force Base. They are hardy and capable of withstanding adverse conditions of the local climate, such as cold winters, hot and dry summers, and windy conditions. The alkalinity of the soil at Malmstrom AFB has potential to slow the growth of many types of plants, trees, and other landscape materials, so vegetation may take longer to mature.

Species on each list are alphabetically listed by their common name, followed by their botanical name, design characteristics, cultural information, and recommended use and miscellaneous notes.

Species not included in this supplement may be planted with written consent from the 341 Civil Engineer Squadron/Conservation Program.

Recommended Species List

Key to symbols

Soil Type

S	Sandy, coarse texture
L	Loam
C	Clay
O	Organic
NP	Not Particular
RS	Rocky Soil

Soil Moisture

H	Hydric: Wet
M	Mesic: Moist
SX	Sub-xeric: Moist to Dry
X	Xeric: Dry and drought resistant

Flower Color

Bl	Blue
Cr	Cream
G	Green
Or	Orange
Pi	Pink
Pu	Purple
R	Red
Wh	White
Y	Yellow
Dk	Dark
Li	Light

Bloom Time

Sp	Spring
Su	Summer
F	Fall

Light

PS	Partial Shade
SH	Shade
Sun	Sun

Life Span

A	Annual
B	Biennial
P	Perennial

Season (grasses)

W	Warm
C	Cool

Comments

EB	Edible fruit
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Lawn Grass Mixtures

Common Name	Landscape Type	Proportion by Weight in Mixture	% Purity	% Germination	Pounds Per Acre in Mixture
Daytona Fine Leaf Perennial Rye	Type 1 landscape	20%	98%	90%	
NuBlue Kentucky Bluegrass	Type 1 landscape	20%	98%	90%	
Blue Chip Kentucky Bluegrass	Type 1 landscape	20%	98%	90%	
Common Kentucky Bluegrass	Type 1 landscape Type 2 Lawns Type 3 Irrigated	20%	98%	90%	
Pennlawn Creeping Red Fescue	Type 1 landscape	20%	98%	90%	
Pixie Turf Type Tall Fescue	Type 2 Lawns Type 3 Irrigated	80%	98%	90%	
Brigade Hard Fescue	Type 3 Non-irrigated	50%			
Ephraim Created Wheatgrass	Type 3 Non-irrigated	30%			
MX86 Sheep Fescue	Type 3 Non-irrigated	20%			
Lodorm Green Needlegrass	Unimproved, non-irrigated natural areas	5	50%		2.5
Rosanna Western Wheatgrass	Unimproved, non-irrigated natural areas	8	25%		2.4
Pryor Slender Wheatgrass	Unimproved, non-irrigated natural areas	6	15%		0.9
Appar Lewis Blue Flax	Unimproved, non-irrigated natural areas	3	10%		0.2

* Seed mixtures include plant cultivar name. Additional information on seed mixtures, seeds, sods, or fertilizers, please reference to **Division 2- Site Work, Section 02912, Seeding, Sodding and Fertilizing** (Appendix I).

Grasses								
Common Name	Botanical Name	Height	Light	Soil Moisture	Soil Type	Season	Bunch/Sod	Comments
Blue Grama	<i>Bouteloua gracilis</i>	18 in	Sun	X	S-C	W	Sod	Good for dry areas; heavy seeding makes good lawn
Bluegrass, Big	<i>Poa ampla</i>	2-4 ft	Sun-PS	SX	L-C	C	Bunch	
Bluestem, Little	<i>Schizachyrium scoparium</i>	2-3 ft	Sun	X	S-C	W	Bunch	Turns red in winter; ornamental
Bluestem, Sand	<i>Andropogon hallii</i>	3 ft	Sun	SX-M	S-L	W	Sod	Use for erosion control on moist sites
Buffalograss	<i>Buchloe dactyloides</i>	6-12 in	Sun	X	L-C	W	Sod	Plugs used to establish; native to eastern MT
Indian Ricegrass	<i>Achnatherum hymenoides</i>	2-3 ft	Sun	X	S	W	Bunch	Ornamental seedhands; seed relished by wildlife
Junegrass, Prairie	<i>Koeleria cristata</i>	10-18 in	Sun	X	S-C	C	Bunch	early to green up in spring; ornamental
Needlegrass, Green	<i>Stipa viridula</i>	2-3 ft	Sun	SX	L-C	C	Bunch	Often used in seed mixes
Sandreed, Prairie	<i>Calamovilfa longifolia</i>	2 ft	Sun-PS	X	S	W	Sod	Stabilizes sandy soils
Switchgrass	<i>Panicum virgatum</i>	4 ft	Sun	M	L-C	W	Bunch	Taller ornamental; birds like seeds
Wheatgrass, Bluebunch	<i>Pseudoroegneria spicata</i> ssp. <i>Spicata</i>	2-3 ft	Sun-PS	X	S-C	C	Bunch	Very hardy; nice ornamental
Wheatgrass, Streambank	<i>Elymus lanceolatus</i> ssp. <i>psammophilus</i>	2 ft	Sun	X-SX	S-C	C	Sod	Good for drought tolerant lawn
Wheatgrass, Thickspike	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	10-24 in	Sun	X	S-C	C	Sod	Fast to establish; erosion control
Wheatgrass, Western	<i>Pascopyrum smithii</i>	12-30 in	Sun	X-SX	L-C	C	Sod	Can take flooding or high watertable
Wildrye, Basin	<i>Leymus cinereus</i>	4-7 ft	Sun	SX	L-C	C	Bunch	Ornamental; can flop with too much moisture; screening

Ornamental Grasses

Common Name	Botanical Name	Height	Width	Light	Soil Moisture	Soil Type	Season	Comments
Blue Avena Grass	<i>Helictotrichon sempervirens</i>	12-18 in	12-15 in	Sun	SX-M	L-C	C	Cream/Tan Color; Evergreen foliage, average water needs
Fescue, Blue	<i>Festuca ovina 'Glauca'</i>	6-18 in	6-9 in	Sun-PS	SX	NP	W	Drought & frost tolerant; prone to rabbit attacks
Maiden Grass	<i>Miscanthus sinensis 'Gracillimus'</i>	4-6 ft	1 in	Sun	SX	L-C	W	plant in late spring to early summer, silvery-green blades, turns bronze in fall
Ribbon Grass	<i>Phalaris arundinacea 'Picta'</i>	18-24 in	18-24 in	Sun-PS	M	NP	W	Invasive, grows well in moist, shady locations
Sweetflag, Variegated	<i>Acorus gramineus 'variegatus'</i>	6-12 in	8-12 in	Sun-PS	M	L-C	W	slowly spreading growth habit, blades form Iris-like fans
Zebra Grass	<i>Miscanthus sinensis 'Zebra'</i>	3-4 ft	2-3 ft	Sun	SX-M	S-L-C	C	very hardy, vigorous growth, yellow and medium green in color

Vines

Common Name	Botanical Name	Height	Light	Soil Moisture	Soil Type	Bloom Color	Bloom Time	Comments
Clematis, Rock	<i>Clematis Columbiana</i>	6 ft	PS-SH	SX-X	L	BIPu	Su	Fluffy seed heads; ground vine; woodlands
Clematis, Virgin Bower	<i>Clematis ligusticifolia</i>	9-18 ft	Sun-PS	X-SX	L	Wh	Su	Fluffy seed heads; good on wire fences
Dutchman's Pipe	<i>Aristolochia macrophylla</i>	20-30 ft	Sun-PS	SX-M	L	Brown/Bronze	Sp/Su	Attracts bees, butterflies, & birds; Fragrant flowers
Honeysuckle, Twinberry	<i>Lonicera involucrate</i>	2-6 ft	SH	M	L	Y	Sp	EB, attracts bees and birds, fragrant flower

Groundcovers

Common Name	Botanical Name	Height	Light	Soil Moisture	Soil Type	Bloom Color	Bloom Time	Comments
Border Jewel/Himalayan knotweed	<i>Polygonum (persicaria) affine</i>	4-6 in	Sun-PS	X-SX	RS	Pi	Su-F	Well-drained soil, spread out to 18 in
Creeping Mahonia	<i>Mahonia repens</i>	18-24 in	Sun-PS	SX-M	NP	Y	Sp	High drought tolerance, produce blue fruits in fall
Creeping Phlox	<i>Phlox stolonifera</i>	6 in	Sun	SX-M	NP	Pi-Wh	Sp	Evergreen, wired, spreads rapidly
Featherleaf Penstemon/Beardtongue	<i>Penstemon pinifolius</i>	12-18 in	Sun	SX-M	NP	Or-R	Su	Sunny locations; Attracts bees, butterflies, & birds; resistant to deer
Purple-Leaf Wintercreeper	<i>Euonymus fortunei 'coloratus'</i>	6-18 in	Sun-SH	SX-M	NP	None		Hardy, flourishes in low temperatures; plant 2-3 ft apart
Wild Strawberry	<i>Fragaria americana/virginiana</i>	6 in	Sun-PS	SX-M	O	Wh	Sp	EB; Hardy; Rocky Mt. Native

Shrubs									
Common Name	Botanical Name	Height	Growth Rate	Light	Soil Type	Soil Moisture	Flower Color	Bloom Time	Comments
Almond, Russian	<i>Prunus tenella</i>	4 ft	Moderate	Sun	L-C	M	Pi	Sp	Excellent nesting and food source for birds
Barberry, Crimson Pygmy	<i>Berberis thunbergii</i> <i>var. atropurpurea</i>	2-3 ft	Slow-Moderate	Sun-PS		SX-X	Wh	Sp	Branches covered in sharp, spiny barbs; burgundy color in full sun; dark red leaves
Buffaloberry, Silver	<i>Shepherdia argentea</i>	8-10 ft	Moderate	Sun	S-C	SX	Y	Sp	Forms clumps; windbreak; EB
Burning Bush	<i>Euonymus alatus</i>	2-5 ft	Rapid	PS-Sun		M	Rd	F	Bright red color in fall; rapid growing; drought tolerance
Caragana	<i>Caragana arborescens</i>	12 ft	Rapid				Y		Windbreak
Cherry, Nanking	<i>Prunus tomentosa</i>	7 ft	Moderate		L		Pi		Short-lived; EB; good drought resistance
Chokecherry, Black	<i>Aronia melanocarpa</i>	6 ft	Moderate		all		Wh		tolerates low, wet areas; produces black fruit, excellent food for birds
Chokecherry, Common	<i>Prunus virginiana</i>	15 ft	Moderate	Sun-PS	S-C	M-SX	Wh	Sp	Forms clumps; EB
Cotoneaster, Centennial	<i>Cotoneaster integerrimus</i>	10 ft	Moderate				Wh-Pi		Showy red berries; should not be planted near crabapples
Cranberry, Bailey	<i>Viburnum trilobum</i>	8-12 ft	Moderate	PS-Sun	L	X-M	Wh	Su-F	Orange-red fall color and red fruits; shallow root system; attracts birds; EB
Currant, Alpine	<i>Ribes alpinum</i>	1-5 ft	Moderate	SH-Sun		SX-X	Y	Sp	can tolerate -50 degree F temperatures; drought tolerant
Currant, Golden	<i>Ribes aureum</i>	6 ft	Moderate	Sun-PS	S-C	M-SX	Y	Sp	EB; attracts hummingbirds
Currant, Wax	<i>Ribes cereum</i>	3 ft	Moderate	Sun-PS	S	SX	Wh-Pi		Rock garden
Dogwood, Red Twig	<i>Cornus sericea</i>	8-10 ft	Rapid	Sun-PS	L-C	M-SX	Wh	Su	fall color & winter interest
Dogwood, Isanti	<i>Cornus sericea</i>	4-5 ft	Rapid	Sun-PS	C-L	M	Wh	Sp-Su	Deciduous shrub; other name Red twig dogwood; prefers damp soils, such as wetlands

Shrubs									
Common Name	Botanical Name	Height	Growth Rate	Light	Soil Type	Soil Moisture	Flower Color	Bloom Time	Comments
Elderberry, Blue	<i>Sambucus cerulea</i>	6-15 ft		PS-Sun	L-C	M	Y	Su	Yellowflowers with blue berries, Foothill valleys, Blooms in July
Forsythia, Meadowlark	<i>Forsythia x 'Meadowlark'</i>	6-11 ft	Moderate	Sun	C-L	X-M	Y		hardest of all forsythias; good windbreak; not adapted to saline soils
Honeysuckle, Blueleaf	<i>Lonicera korolkowii</i>	8 ft	Moderate				Y-Pi		Plant only Russian aphid resistant cultivars
Juniper, Blue Chip	<i>Juniperus horizontalis 'Blue Chip'</i>	8-12 in	Moderate	Sun	L-C	X-M	none		Deer resistant; low watering; attracts birds; adapts well to snow/frost
Juniper, Buffalo	<i>Juniperus sabina 'Buffalo'</i>	12-15 in	Moderate	Sun	L-C	X-M	none		Widely Adaptable soil and moisture type; no flower; low spreading
Juniper, Common	<i>Juniperus communis</i>	3 ft	Moderate	Sun	S-L	X-SX	none		Birds (berry)
Juniper, Hughes	<i>Juniperus horizontalis 'Hughes'</i>	1 ft	Moderate	Sun-PS	all		none		Range of soil types; heat and drought tolerant; silvery blue
Juniper, Savin	<i>Juniperus sabina</i>	4-6 ft	Moderate	Sun	all	all	none		Deer resistant; once established, needs only occasional watering, cold resistant
Lewis's Mock Orange	<i>Philadelphus lewisii</i>	6-8 ft		Sun-PS	S	SX	Wh	Su	Fragrant flowers; ornamental; drought tolerant
Lilac, Common	<i>Syringa vulgaris</i>	6 ft	Moderate	Sun-PS	S	SX	Wh	Su	Fragrant flowers; ornamental; drought tolerant
Mahogany, Curl-Leaf Mountain	<i>Cercocarpus ledifolius</i>	8 ft	Moderate	Sun-PS	S-L	X-SX	Wh	Su	High elevation; rock garden; likes limestone soils
Ninebark	<i>Physocarpus malvaceus</i>	3-5 ft	Moderate	PS-Sun	S-C	S-SX	Wh	Su	Aspen understory
Plum, American	<i>Prunus americana</i>	3-24 ft	Moderate	Sun	S-C	M	Wh	Sp	Bloom April to May
Plum, Wild	<i>Prunus americana</i>	15 ft	Moderate	Sun-PS	S-C	X-M	Wh	Sp	Forms clumps; Eastern MT. native
Potentilla	<i>Dasiphora floribunda</i>	3 ft	Moderate				Y	Sp-Su	adaptable to soils with high pH; hardy and flowers thru most of seasons
Potentilla, Mt. Everest	<i>Potentilla fruticosa 'Mount Everest'</i>	2-3 ft	Moderate	Su	S-C	SX-X	Wh	Su	Don't overwater; long lasting flowers; drought tolerant; bushy

Shrubs									
Common Name	Botanical Name	Height	Growth Rate	Light	Soil Type	Soil Moisture	Flower Color	Bloom Time	Comments
Rabbitbrush	<i>Chrysothamnus nauseosa</i>	2-4 ft		Sun	S-L-C	Low	Y	Su	Grasslands and foothills, Blooms August to October
Rose, rugosa	<i>Rosa rugosa</i>	4-5 ft		Sun	S-L	M	Red	Su	Erosion control plant, can be invasive, drought tolerant
Rose, Woods	<i>Rosa woodsii</i>	4 ft	Moderate	PS-Sun	S-L	M-SX	Pi	Su	Naturalize; spreads; birds & bees
Sagebrush, Big	<i>Artemisia tridentata</i>	3-6 ft		Sun	S-C	X-SX	Y	Su	Naturalize with native grasses; aromatic
Sagebrush, Silver	<i>Artemisia cana</i>	4 ft	Moderate				Y		good tolerance of alkali soils
Saltbrush, Four-wing	<i>Atriplex canescens</i>	6 ft		Sun	S-L	X-SX	Wh	Sp	very drought tolerant; disturbed areas
Sandcherry, Purpleleaf	<i>Prunus besseyi</i>	3-5 ft	Moderate	Sun	S-L	SX	Wh	Sp	tasty fruit for jams; growth habit varies; red fall colour
Serviceberry	<i>Amelanchier alnifolia</i>	2-16 ft	Moderate	Sun	S-L	Low		Su	Foothills to prairie ravines, Blooms May to June
Silverberry	<i>Elaeagnus commutate</i>	6 ft	Moderate	Sun	L-C	SX-X	Wh	Sp	Spreading; native to streambanks; gray leaves
Snowberry	<i>Symphoricarpos albus</i>	3-4 ft	Moderate	S-SH	S-L	SX-M	Wh	Su	Aspen understory; spreads; erosion control; white berries
Spirea, Goldflame	<i>Spiraea x bumalda 'Goldflame'</i>	3 ft	Rapid	PS-Sun	C-L	SX-M	Pi	Sp-Su	hardy shrub that will tolerate most soils and moisture; leaves fade from red to yellow then green
Sumac, Skunkbrush	<i>Rhus trilobata</i>	6-8 ft	Slow	PS-Sun	S-C	SX-X	Y	Su	Red Fall color; deer browse
Sumac, Smooth	<i>Rhus glabra L.</i>	12 ft	Slow	Sun	S-C	Low	Y	Sp-Su	well-drained soils, hardy species, can become weedy
Willow, Sandbar	<i>Salix exigua</i>	10 ft	Rapid						aggressive suckering provides excellent streambank stabilization
Winterfat	<i>Ceratoides (Krascheninnikovia) lanata</i>	2-3 ft		Sun	L-C	X	Wh	Sp	Naturalize with native grasses

Trees							
Small Deciduous Trees							
Common Name	Scientific Name	Height	Growth Rate	Light	Soil Moisture	Soil Type	Comments
Buckeye, Ohio	<i>Aesculus glabra</i>	20 ft	Moderate	Sun			nuts are eaten by squirrels, poor drought resistance
Cherry, Black	<i>Prunus serotina</i>	16 ft	Moderate				good food source for birds
Crabapple, Siberian	<i>Malus baccata</i>	15 ft	Moderate				Needs moist soils; should not be planted near juniper, cedar, or cotoneaster
Hawthorn, Arnold	<i>Crataegus arnoldiana</i>	16 ft	Moderate				large thorns, bright orange-red fruit
Hawthorn, Black	<i>Crataegus douglasii</i>	16 ft	Moderate				thorny branches, excellent nesting for birds, native to MT
Maple, Amur	<i>Acer ginnala</i>	15 ft	Moderate				sensitive to phenoxy herbicides, reddish fall colors; also known as Flame Maple
Pear, Ussurian	<i>Pyrus ussuriensis</i>	20 ft	Moderate	Sun-PS	SX-X	all	does not tolerate saline soils
Pine, Mugo	<i>Pinus mugo</i>	20	Slow	Sun	M		dense branches; attracts birds, deer resistant; easy care; showy fruit
Spring Snow Crabapple	<i>Malus "Spring Snow"</i>	15-25 ft	Rapid	Sun	M	NP	
Medium/Large Deciduous Trees							
Common Name	Scientific Name	Height	Growth Rate	Light	Soil Moisture	Soil Type	Comments
Ash, Green	<i>Fraxinus pennsylvanica</i>	50-60 ft	Moderate	Sun-PS	SX-M	NP	Shade tree
Aspen, Quaking	<i>Populus tremuloides</i>	60 ft	Rapid	Sun-PS	M-SX	NP	Forms groves; shallow roots
Boxelder	<i>Acer negundo</i>	18 ft	Moderate				sensitive to phenoxy herbicides
Cottonwood, Black	<i>Populus trichocarpa</i>	150 ft	Rapid	Sun	M	S-L	Fast growing; native to higher elevations
Cottonwood, Narrowleaf	<i>Populus angustifolia</i>	60-90 ft	Rapid	Sun	M	L	Common on streamsides in lower elevation

Medium/Large Deciduous Trees

Common Name	Scientific Name	Height	Growth Rate	Light	Soil Moisture	Soil Type	Comments
Cottonwood, Plains	<i>Populus deltoides</i>	65-100 ft	Rapid	Sun	M	L-C	Large shade tree; fast growing
Elm, Siberian	<i>Ulmus pumila</i>	25 ft	Rapid				sensitive to phenoxy herbicides, brittle wood
Hackberry, Common	<i>Celtis occidentalis</i>	15 ft	Moderate				adaptability, somewhat tolerant to alkaline soils
Honeylocust	<i>Gleditsia triacanthos</i>	20 ft	Moderate				Thorns, develops deep tap root system
Linden, American	<i>Tilia americana</i>	25 ft	Moderate			L-C	can tolerate flooding
Locust, Black	<i>Robinia pseudoacacia</i>	25 ft	Rapid				Tolerates dry soils, produces white flowers
Maple, Autumn Blaze	<i>Acer X Freemanii</i>	40-60 ft	Rapid	Sun	M-X	NP	Not tolerant of high soil pH, shade tree, shallow root system that surfaces
Oak, Bur	<i>Quercus macrocarpa</i>	18 ft	Moderate				Long-lived, deep taproot
Poplar, White	<i>Populus alba</i>	25 ft	Rapid	Sun	SX-M	L	numerous root sprouts, strong branches
Walnut, Black	<i>Juglans nigra</i>	16 ft	Moderate				Sensitive to soil conditions, produces edible nuts
Willow, Golden	<i>Salix alba</i>	25 ft	Rapid				Fair drought resistance, branches shed easily

Conifers

Common Name	Scientific Name	Height	Growth Rate	Light	Soil Moisture	Soil Type	Comments
Arborvitae	<i>Thuja occidentalis</i>	30-45 ft	Moderate	Ps-Sun	M	C	also known as White Cedar; cold hardiness
Birch, Paper	<i>Betula papyrifera</i>	50 ft	Moderate	Sun	M	L	Distinctive white bark; needs well drained soil; native to northern MT
Fir, Douglas	<i>Pseudotsuga menziesii</i>	15-50 ft	Moderate	Sun	M	S-L	Limited availability for locally propagated plants
Juniper, Rocky Mtn.	<i>Juniperus scopulorum</i>	12-20 ft	Moderate	Sun	SX-X	S-C	Drought tolerant

Conifers

Common Name	Scientific Name	Height	Growth Rate	Light	Soil Moisture	Soil Type	Comments
Larch, Siberian	<i>Larix sibirica</i>	16 ft	Moderate				cold hardy tree, needles shed yearly
Pine, Austrian	<i>Pinus nigra</i>	17 ft	Moderate			S-C	dense needle growth, can handle smog
Pine, Lodgepole	<i>Pinus contorta</i>	17 ft	Moderate	Sun		L	Pine beetle, grows best on moist loams
Pine, Lumber	<i>Pinus flexilis</i>	40-60 ft	Slow	Sun	SX-X	S-L	Unique form
Pine, Ponderosa	<i>Pinus ponderosa</i>	80 ft	Moderate	Sun	SX-M	S-C	Drought and wind tolerant
Pine, Scotch	<i>Pinus sylvestris</i>	17 ft	Moderate				prefers moist well-drained soils
Redcedar, Eastern	<i>Juniperus virginiana</i>	10 ft	Moderate				Should not be planted near crabapples, juneberries, or hawthorns
Spruce, Black Hills	<i>Picea densata</i>	12 ft	Slow				grows best on moist loams
Spruce, Engelmann	<i>Picea engelmannii</i>	14 ft	Slow				Can tolerate cold frost pockets
Spurce, Colorado Blue	<i>Picea pungens</i>	15-70 ft	Moderate	Sun	SX-X	S-L	excellent screening tree when massed

Wildflowers									
Common Name	Botanical Name	Height	Light	Water	Soil Type	Life Span	Flower Color	Blood Time	Comments
Aster, Smooth	<i>Aster laevis</i>	3 feet	Sun	SX	L	P	Bl	F	Attracts butterflies; leggy if too much moisture; self seeds
Beebalm, Horsemint	<i>Monarda fistulosa</i>	18-24 in	Sun-PS	SX	S-L	P	BlPu	Su	Showy; attracts butterflies and bees; Leggy if too much water
Blanketflower, Indian	<i>Gaillardia aristata</i>	2 ft	Sun	X-SX	S-L	P	Y-O	Su	Long blooming; can be short lived
Buckwheat, Sulfur	<i>Eriogonum umbellatum</i>	6-12 in	Sun-PS	X-SX	S-L	P	CR	Su	Easiest buckwheat; mat forming; semi-evergreen foliage
Cactus, Prickly Pear	<i>Opuntia polyacantha</i>	6-12 in	Sun	X	S-L	P	Y-Pi	Su	Showy blooms
Coereopsis, Plains	<i>Coreopsis tinctoria</i>	10-12 in	Sun	X	S-L	B	Y	Su	Native to eastern MT
Columbine, Colorado	<i>Aquilegia coerulea</i>	12-30 in	PS	SX-M	S-L	P	Bl+W	Su	Flower color can vary
Coneflower, Pale Purple	<i>Echinacea angustifolia</i>	2 ft	Sun	X	S-L	P	LtPu	Su	Drought tolerant; attracts butterflies
Coneflower, Prairie	<i>Ratibida columnifera</i>	2 ft	Sun	X	S-L	P	Y	Su	Self seeds; short lived
Daisy, Cutleaf Fleabane	<i>Erigeron compositus</i>	3-8 in	Sun	X	S	P	W	Su	Drought tolerant; self seeds
Daisy, Showy Fleabane	<i>Erigeron speciosa</i>	12-20 in	Sun-PS	X-SX	S-L	P	PuBl	Su	Drought tolerant; good cut flower
Flax, Blue	<i>Linum perenne lewisii</i>	18-24 in	Sun	X	S-C	P	Bl	Sp-Su	Self Seeds; short lived; good naturalized
Geranium, Sticky	<i>Geranium viscosissimum</i>	1-3 ft	Sun-PS	SX-M	S-L	P	Pi	Su	Can sprawl in shade; fall color
Globemallow, Scarlet	<i>Sphaeralcea coccinea</i>	4-8 in	Sun	X	S-C	P	Or	Su	Birds and small mammals eat the fruits
Indian Paintbrush	<i>Castilleja species</i>	1-2 ft	Sun	SX-M	S-L	P	Mixed	Su	Available at some native nurseries; needs dry soils
Lupine, Silkey	<i>Lupinus, sericeus</i>	18 in	Sun-PS	X	S-L	P	BlPu	Sp-Su	Best direct seeded; scarify seed coat and use inoculant

Wildflowers									
Common Name	Botanical Name	Height	Light	Water	Soil Type	Life Span	Flower Color	Blood Time	Comments
Lupine, Silvery	<i>Lupinus argenteus</i>	18 in	Sun	X-SX	S-L	P	BlPu	Sp-Su	Best direct seeded; scarify seed coat
Pearly Everlasting	<i>Anaphalis margaritacea</i>	24 in	PS	SX	S-L	P	Wh	Su	Aggressive; provide plenty of space
Penstemon, small-flowered	<i>Penstemon procerus</i>	10-12 in	Sun-PS	SX	S-L	P	DkBl	Su	Longer lived Penstemon
Phacelia, Narrowleaved	<i>Phacelia linearis</i>	10 in	Sun	X-SX	S-L	A	Bl	Sp	Nice filler in dry gardens with penstemons
Prairie-clover, Purple	<i>Dalea purpurea</i>	18 in	Sun	SX-M	S-C	P	Pu	Sp	Legume
Prairie-clover, White	<i>Dalea candida</i>	18 in	Sun	SX-M	S-C	P	Pu	Sp	Legume
Pussytoes, Rosy	<i>Antennaria microphylla</i>	6 in	Sun-PS	X-SX	S-L	P	Wh	Sp	Great groundcover
Sunflower, Maximilian	<i>Helianthus maximiliana</i>	3-4 ft	Sun	X-SX	S-L	P	Y	F	Tall; native to eastern MT
Thermopsis, Round-leaved	<i>Thermopsis rhombifolia</i>	12 in	Sun	X-SX	S-L	P	Y	Su	Legume
Vetch, American	<i>Vicia americana</i>	24 in	Sun-PS	SX	S-C	P	Pu	Su	Legume; has tendrils
Yarrow	<i>Achillea millefolium</i>	24 in	Sun	X-SX	S-C	P	Wh	Su	Aggressive self seeder; seed small amts. In prairie mixes

REFERENCES

Information and photos of species is provided from:

USDA, NRCS. 2010. The PLANTS Database (<http://plants.usda.gov>, 28 October 2010). National Plant Data Center, Baton Rouge, LA 70874-4490 USA

Ornamental Grass Information:

Bluestem Nursery. 2011. Ornamental Grasses. (<http://www.bluestem.ca/>, 2011). Laurier, WA USA.

Wildflower Information:

Lady Bird Johnson Wildflower Center. 2011. NPIN: Native Plant Database. (<http://www.wildflower.org/plants>). 4801 La Crosse Avenue, Austin, Texas 78739 USA.

APPENDIX I

DIVISION 32 - SITE WORK
SECTION 32 92 12
SEEDING, SODDING AND FERTILIZING

1. GENERAL.

The work described in this section shall consist of providing all labor, services, fertilizer, sod, seed and equipment to establish grasses per these specifications. The Contractor shall return site to grass and maintain until lawn is established.

The Contractor shall be or shall employ an expert plantsman who will be present during all seeding and sodding operations and direct the work. All vegetation must meet or exceed the cold hardiness rating for USDA hardiness zone 3a (-35 to -30F).

All areas designated on the drawings and/or disturbed prior to and during construction shall be seeded to grass except for existing lawn areas, which shall be sodded. The Contractor may strip existing sod prior to excavation and utilize it to sod the area or furnish new sod.

2. APPLICABLE PUBLICATIONS.**2.1 American Sod Producers Association.**

Guideline Specifications to Sodding

3. MATERIAL.

3.1 Existing Sod. Existing sod may be carefully stripped in strips not to exceed 3 feet in length and one foot in width and shall have a soil thickness of approximately 1 inch. The sod shall be carefully cut along straight lines. Sod shall be stored on pallets and kept moist and green until ready for installation. Sod that is torn or irregularly shaped or that is allowed to wither, dry out, mold, or mildew shall be discarded and removed.

3.2 Sod. All sod shall be Grade A Kentucky Bluegrass sod and contain approximately equal proportions of Glade, Adelphi, Midnight, and Limonsune. Certification of composition must be provided by the sod supplier. The sod shall contain absolutely no noxious weeds and less than five plant per acre broadleaf weeds.

3.3 Grass Seed. Grass seed will be provided by the Contractor. All grass seed shall be certified free from noxious weeds, re-cleaned, Grade A recent crop seed. It shall be treated with appropriate fungicide and delivered to the site in sealed containers with dealer's guaranteed analysis. All seed shall be properly stored by the Contractor and any seed damaged during such storage shall be replaced by the Contractor at his expense.

The seed mixture will depend on the specified type of area to be seeded. All seed should be the selected varieties, or alternative equal varieties accepted in advance by the Government. The specified varieties establish the grass performance characteristics desired. Requests for approval as an equal shall furnish all information necessary for the Contracting Officer to make a determination whether or not the requested substitution is equal to or better than the specified variety in all respects. The Contractor shall submit certifications to the Contracting Officer for approval.

3.3.1 Lawn Grass Mixture for Type 1 landscape

<u>Plant Cultivar & Species</u>	<u>Proportion by Weight in Mixture</u>	<u>% Purity</u>	<u>% Germination</u>
Daytona Fine Leaf Perennial Rye	20%	98%	90%
NuBlue Kentucky Bluegrass	20%	98%	90%
Blue Chip Kentucky Bluegrass	20%	98%	90%

Common Kentucky Bluegrass	20%	98%	90%
Pennlawn Creeping Red Fescue	20%	98%	90%

3.3.2 Lawn Grass Mixture for Type 2 Landscape Lawns and Type 3 Irrigated Lawns

<u>Plant Cultivar & Species</u>	<u>Proportion by Weight in Mixture</u>	<u>% Purity</u>	<u>% Germination</u>
Common Kentucky Bluegrass	20%	98%	90%
Pixie Turf Type Tall Fescue	80%	98%	90%

3.3.3 Lawn Grass Mixture for Type 3 Non-Irrigated Lawns

<u>Plant Cultivar & Species</u>	<u>Proportion by PLS Count</u>
Brigade Hard Fescue	50%
Ephraim Crested Wheatgrass	30%
MX86 Sheep Fescue	20%

3.3.4 Native Grass Mixture for Unimproved, Non-Irrigated Natural Areas

<u>Plant Cultivar & Species</u>	<u>Proportion by PLS Count</u>	<u>% of Mixture</u>	<u>Pounds per Acre in Mixture</u>
Lodorm green needlegrass	5	50%	2.5
Rosanna western wheatgrass	8	25%	2.4
Pryor slender wheatgrass	6	15%	0.9
Appar lewis blue flax	3	10%	0.2

Seed shall comply with and be labeled in accordance with current Federal and Montana seed quality criteria. Seed shall be certified weed free and have been grown in the North American Continent above 47° latitude. All seed shall be standard grade adapted to Montana conditions.

3.3.5 Source Quality Control: Seed materials shall be subject to inspection and acceptance. Contracting Officer reserves right to reject at any time or place prior to acceptance of work, seed which in Contracting Officer's opinion fails to meet these specification requirements. Inspection is primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance. Inspection shall be made periodically during seeding, at completion, and at end of warranty period.

3.3.6 Testing Requirements: Seed and seed label shall conform to current State and Federal regulations and subject to testing provisions of Association of Official Seed Analysis.

3.4 Topsoil. Topsoil from existing stripped material or from off-site. Off-site material shall have compost added to the topsoil during new construction or landscape enhancement. Topsoil shall be obtained from well-drained areas and shall be free of any foreign matter, toxic substances, and any material or substances that may be harmful to plant growth. Topsoil shall be tested by an independent soil lab and if required, amended or processed to conform to the following requirement.

Topsoil Specifications Adding 1 Yard of Compost per 1000 square feet

<u>Characteristic</u>	<u>Optimum</u>	<u>Minimum</u>	<u>Maximum</u>
pH	6.5	5.5	8.3
Nitrate (#/ac)	50	1	300
Organic Matter (%)	2 to 3	0.5	5

Phosphorus (Olsen, ug/g)	40	2	150
Potassium (ug/g)	500	100	1000
Sodium (meq/100g)	< .5	n/a	2.5
Calcium (meq/100g)	> 5.0	0.5	20
Sulfate as S (ug/g)	20 to 100	3	1000
Conductivity (mmhos / cm)	< 0.5	n/a	2.5
Lime (qualitative)	Slight	None	Medium

The Contractor shall furnish off-site topsoil and amendments.

3.5 Fertilizer. Fertilizer shall only be used in the improved portions of base that receive daily irrigation. On seeded areas the fertilizer shall be spread 12-months after seeding or as soon as the grass has become established, whichever is sooner. On sodded areas the fertilizer shall be spread just prior to laying the sod. Fertilizer shall be 10-40-10 and be furnished by the Contractor and shall be applied to selected areas at a rate of 400 pounds per acre.

Fertilizer to be spread on areas to be seeded should be commercially prepared, complete, uniform in composition, dry and free flowing. The fertilizer should be delivered to the site in the original waterproof containers, each bearing the manufacturer's statement of analysis. If stored at the site, protect fertilizer from the elements at all times.

Fertilizer to be spread on sodded areas shall meet the same specifications but shall be spread on the prepared surface, underneath the sod and just prior to laying the sod on top of the prepared surface.

The Contracting Officer reserves the right to request the contractor to obtain independent tests of the material at any time and to accept or reject the material based on these tests.

If the fertilizer is not used immediately, the Contractor shall store the unused material in such a manner that its usefulness will not be impaired.

3.6 Fiber Mulch Fiber mulch should be applied to all seeding areas (Type 1 to 3 and Unimproved Areas) where feasible. Uniformly apply mulch after seeding. **Mulch material will be certified weed free.** The fiber mulch shall be an organic wood cellulose fiber mulch.

Wood cellulose fiber or paper mulch may be applied by hydraulic equipment with water as the carrying agent. Continuous agitation of the mulch will be maintained to provide uniform suspension and distribution of the material. Application on slopes should work downward from the top to the toe of the slope. Application rate should be 2,000 pounds/acre

Commercially available tackifiers can be used as mulch binders. Application should be evenly distributed over the revegetation site. Refer to manufactures product guidelines for recommended uses, application methods and rates.

4. CONSTRUCTION.

4.1 Sodding. The area to be sodded shall be covered with 6 inches of lightly compacted topsoil as specified in the Section: Site Grading and Excavation. The topsoil shall be graded smooth and uniform and so that the newly sodded surface will blend smoothly with existing turf. Fertilizer shall be placed on the prepared surface. The sod shall be placed on top of the fertilizer and watered as recommended by the sod supplier, in conformance with "Guideline Specifications to Sodding", or a minimum of once per day, whichever provides more moisture. All sod shall be placed with each segment tightly butted to adjacent sections and to existing turf. There shall be no holes, discontinuities, or ridges in the finished surface. The Contractor shall maintain the sod to include watering and two grass cuttings. The initial grass cutting shall commence when the sod reaches 4 inches in height. At this time it will be cut back to two inches. The second cutting will be at a height of 3 1/2 to 4 inches. An inspection will be held after the second cutting. If the sod fails to grow and dies, the sod shall be replaced by the Contractor at no additional cost to the Government. All irrigated lawn areas disturbed by construction shall be sodded.

4.1.1 Fertilizing Sod. The Contractor shall fertilize the prepared surface just prior to laying the sod. Both nitrogen and phosphate shall be applied at rates of 0.5 pounds per 100 square feet of sodded surface or as recommended by a reputable commercial sod supplier.

4.2 Seeding. The amount of area to be seeded shall be based on shaded area of drawings. All other areas disturbed during construction shall be the responsibility of the Contractor.

4.2.1 Time of Seeding. Seeding should primarily occur between October 15 and May 15. Warm season grasses should be planted in the summer with adequate watering. The seed shall not be drilled or sown during windy weather, snow is on the ground, or when ground is otherwise untillable. Seeding in questionable conditions must be approved by the Contracting Officer.

4.2.2 Preparation of Seedbed. Seed bed preparation should not commence until the moisture conditions make the ground area and soil friable. The ground should be hand or machine raked so as to remove all debris, clods, rocks, and other material larger than 1 inch, to a depth 2 inches. Such debris, clods, rocks, and other material so removed should be disposed of off the base at the contractor's expense. Grade lawn areas to finish grades, filling as needed or removing surplus earth and floating areas to a smooth uniform grade. All lawn areas should slope to drain. Where no grades are shown, surfaces should have a smooth and continual grade between existing or fixed controls such as walks, curbs, catch basins, elevations at steps or buildings. Roll, scarify, rake, and level as necessary to obtain true even lawn surfaces. All finish grades must have approval of the contracting officer before seed is sown.

4.2.3 Fertilizing Seeded Grass. Grass species do not utilize fertilizer very effectively in the first year. Fertilizer should only be applied at the time of seeding on sites with poor fertility or granitic soils (**determined by a soil test**). Fertilizer, 10-40-10, shall be applied to seeded areas at a rate of 400 pounds per acre. A time released fertilizer may have benefits depending on site conditions.

4.2.5 Seeding Turf (Type 1 to 3) Grass. Soil that is too loose or dry for good handling must be moistened and lightly rolled before seeding. Small grass, forbs, and legume seeds shall be planted no deeper than ½ inch. Large grass seeds shall be planted no deeper than 1 inch. Seed shall be sown at the rate of 5 pounds of lawn grass mixture for Type 1 landscape lawns per 1,000 square feet, or 7 pounds of lawn grass mixture for Type 2 landscape lawns and Type 3 irrigated lawns per 1,000 square feet, or 2.5 pounds of lawn grass mixture for Type 3 landscape non-irrigated lawns per 1,000 square feet. Seed should be sown exercising great care that a uniform distribution of seed is obtained. Seeding should be done on a still day, using a drill seeder. On slopes too steep to drill a hopper type broadcast spreader may be used as long as the seed is raked and covered afterwards.

4.2.6 Seeding Native Grass in Unimproved Areas. Seeding in unimproved areas is restricted by moisture conditions and therefore shall only be planted between October 15 and May 15. Those portions of the unimproved areas with irrigation available (i.e., a nearby fire hydrant) may be seeded at any time of the year with either a drill seeder or hydro-seed as long as the watering requirements can be strictly adhered to. Small grass, forbs, and legume seeds shall be planted no deeper than ½ inch. Large grass seeds shall be planted no deeper than 1 inch. Seed shall be sown at the seed mixture and rate shown in paragraph 3.3.4. Seed should be sown exercising great care that a uniform distribution of seed is obtained. Seeding should be done on a still day, using a drill seeder. On slopes too steep to drill, a hopper type broadcast spreader may be used as long as the seed is raked and covered afterwards.

4.2.7 Hand Seeding. Hand seeding or mechanical seeding of narrow medians or small areas is permissible as long as soil preparation, mulching, and all other requirements are met.

4.3 Establishment.

4.3.1 General. The Contractor shall be responsible for seeding and growth.

4.3.2 Water. Water may be available from an existing Malmstrom source. The Contractor is responsible to supply water required to establish stand of grass either from the Malmstrom source or his own source. The Contractor shall provide portable watering equipment when needed.

Adequate moisture must be available at all times during the pre-sprout phase and the top 1 inch of soil should stay moist at all times. The germination time for grass seed ranges from 5 to 30 days depending on the variety. It can be even longer than this in cooler temperatures. Newly seeded areas will be watered at least twice per day but the overall frequency and duration of watering shall be determined on-site by the Contractor based on soil conditions, temperature, and weather. For Type 1, 2 and 3 irrigated and non-irrigated lawns, watering will be reduced to once a day when the grass reaches a height of 4 inches. After the second cutting the grass shall be considered established and special watering regimes may cease.

Unimproved areas with available irrigation may be hydro-seeded as long as watering requirements can be adhered to. Regardless of seeding mechanism, the top 1 inch of soil should stay moist at all times and be watered at least twice per day, but the overall frequency and duration of watering shall be determined on-site by the Contractor based on soil conditions, temperature, and weather. When the grass reaches a height of 4 inches it shall be considered established and special watering regimes may cease.

Contractors will avoid:

- over watering that results in puddles on the surface
- runoff and seed movement on sloping ground
- over watering that allows the soil to get soggy and spongy
- overwatering areas that are shaded
- uneven watering due to sprinklers that are clogged, not adjusted or inadequately designed
- under watering new grass seed, especially not often enough due to any and all reasons

4.3.3 Cutting. The initial grass cutting shall commence in Type 1 to 3 lawns when the new grass reaches a height of 4 inches. At this time the new grass will be cut back to 3 inches. A final inspection will be held after the 2nd cutting. Reseed and water areas in which no stand of grass is established.

4.3.4 Reseeding. Bare spots exceeding 16 square inches will require reseeding. Reseeding shall be completed only in such period as may be allowed by the Contracting Officer. Reseeding shall be with the same seed types, mixture and method as originally used and shall be applied at the rate specified for the original seeding in a manner that will cause a minimum of disturbance of the existing stand of grass. Reseeding shall be accomplished at no additional cost to the Government. Seed for reseeding will be supplied by the Contractor.

4.4 Repair. If at any time before completion and acceptance of the entire work covered by this contract, any portion of the surface becomes gullied or otherwise damaged following seeding the affected portion shall be repaired to re-establish the condition and grade of the soil prior to seeding and shall then be reseeded as specified above, at the Contractor's expense.

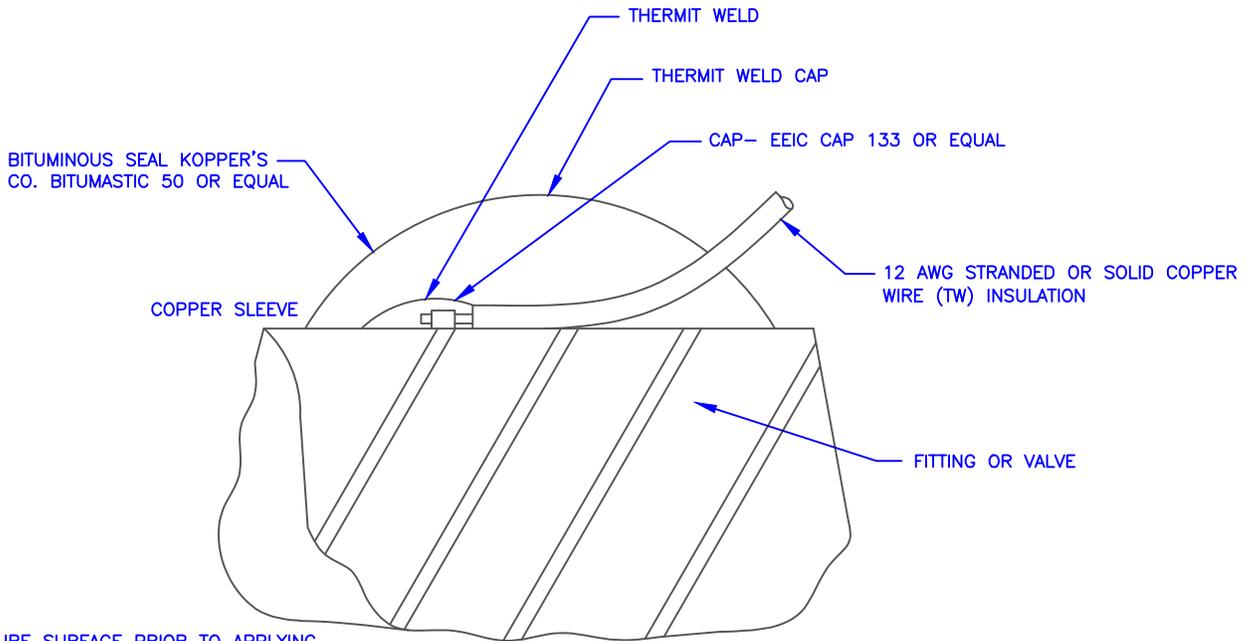
If sod or seeded grass fails to grow or dies, the affected portion shall be removed and the area repaired and resodded or seeded, as appropriate, by the Contractor at no additional expense to the Government. The Contractor shall be responsible for maintaining the grass and sod until it is successfully established.

END OF DOCUMENT

BASE CONSTRUCTION STANDARD DETAILS

NOTES:

1. LOOP THE WIRE TO PROVIDE SLACK AND LAY WIRE CLOSE TO STRUCTURE.
USE CARE WHEN BACKFILLING SO AS NOT TO BREAK WIRE AT WELD OR ANODE.
2. BACKFILL WITH SOIL AND TAMP AROUND ANODE.
3. SATURATE ANODE WITH A MIN. 2 GALLONS FRESH WATER AFTER ANODE HAS BEEN BURIED WITH 6" BACKFILL ON TOP OF ANODE.
4. NEVER HANDLE ANODE BY LEAD WIRE. USE ONLY THE ANODE PACKAGE.
5. ANODE PACKAGES SHALL BE INSTALLED WITH LONG AXIS IN THE VERT. POSITION.
6. THERMIT WELD ANODE LEAD WIRE TO STRUCTURE AND COAT WITH BITUMASTIC 50 OR EQUAL.
7. PROTECT WITH THERMIT WELD CAP.
8. TEST STATIONS WILL NOT BE INSTALLED IN PAVEMENT OR STREET.
9. INSTALL TEST STATION ON EVERY 10TH VALVE OR VALVE FITTING
10. INSTALL SACRIFICIAL ANODE ON EVERY METAL FITTING OR VALVE.



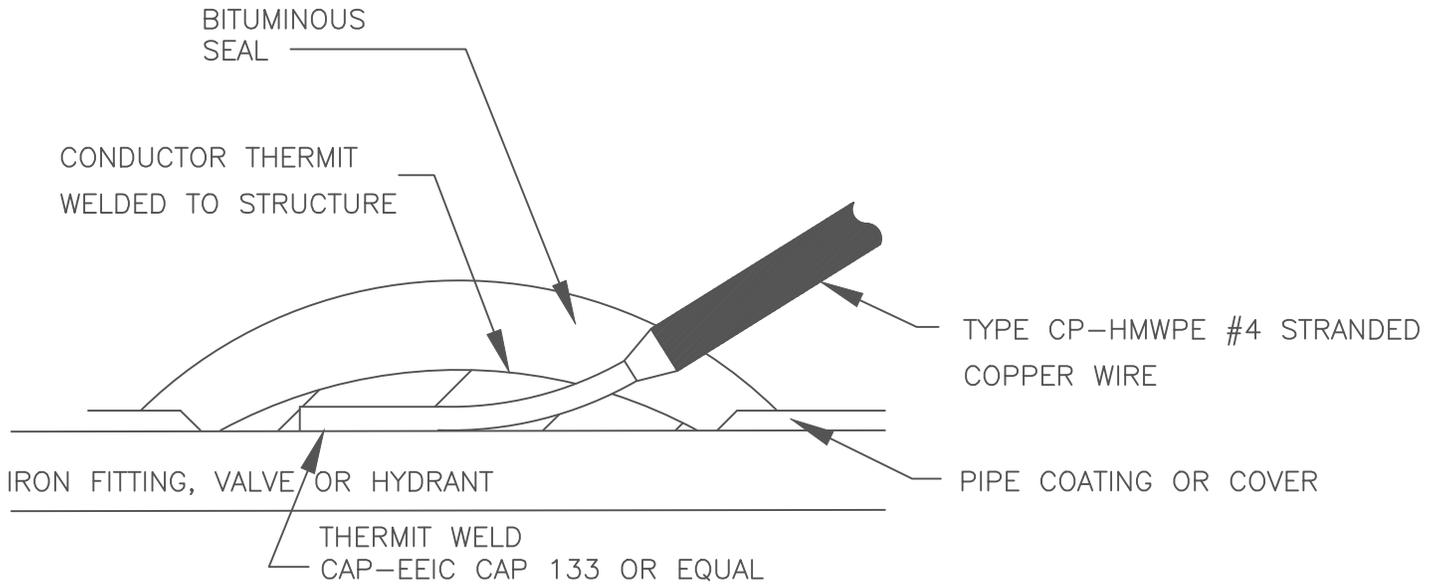
TYPICAL CABLE CONNECTION TO STRUCTURE

NO SCALE



Malmstrom AFB
Standard Drawings

CABLE CONNECTION
TO STRUCTURE



NOTES:

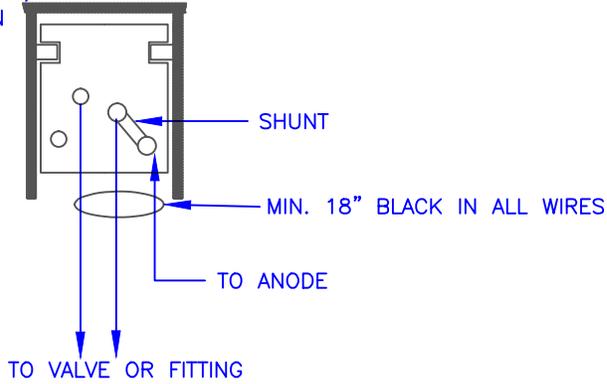
1. ALL STEEL VALVE BOXES SHALL BE BONDED.
2. METAL SURFACE TO BE DRY AND FREE OF FOREIGN MATERIAL.
3. CONNECTION AND EXPOSED METAL TO HAVE 1/2" MINIMUM INSULATION.



Malmstrom AFB
Standard Drawings

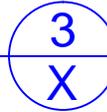
THERMIT WELD

NOTE: SEE STD. DWG 46,
1/3, FOR INSTALLATION
INSTRUCTION.

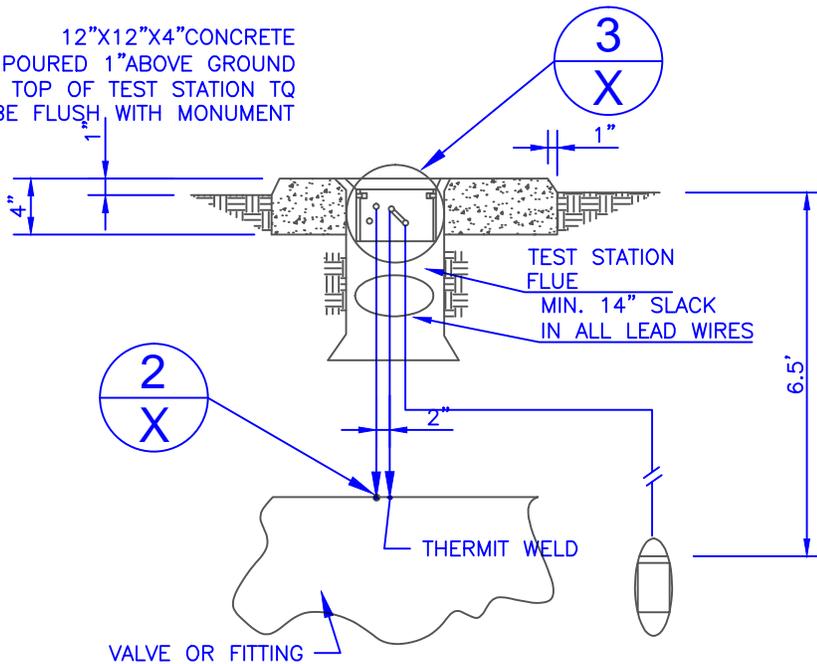


TERMINAL IN TEST STATION

NO SCALE

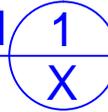


12"X12"X4" CONCRETE
MONUMENT POURED 1" ABOVE GROUND
SURFACE TOP OF TEST STATION TO
BE FLUSH WITH MONUMENT



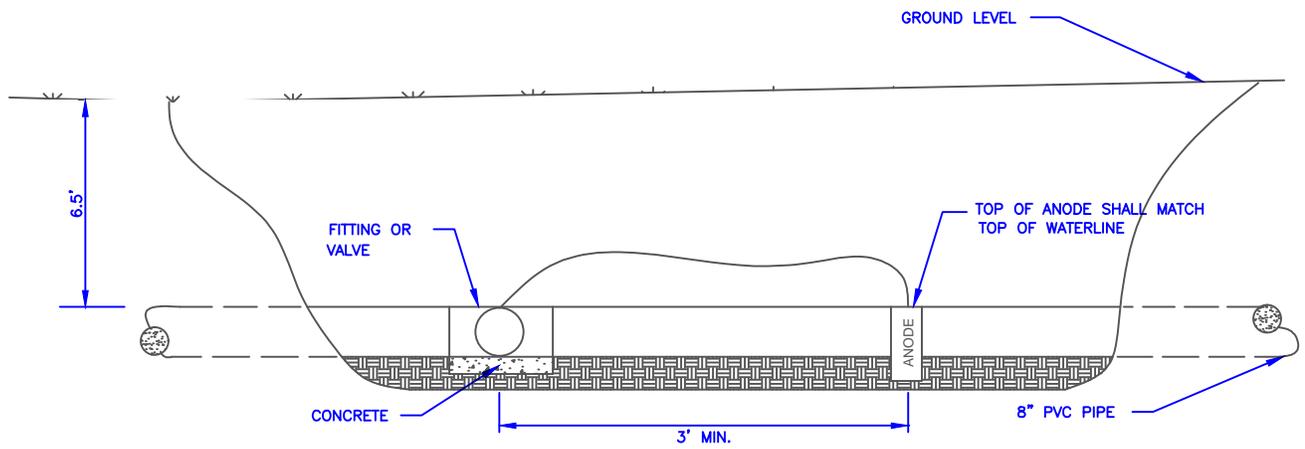
TEST STATION INSTALLATION

NO SCALE



Malmstrom AFB
Standard Drawings

TERMINAL & TEST
STATION INSTALLATION



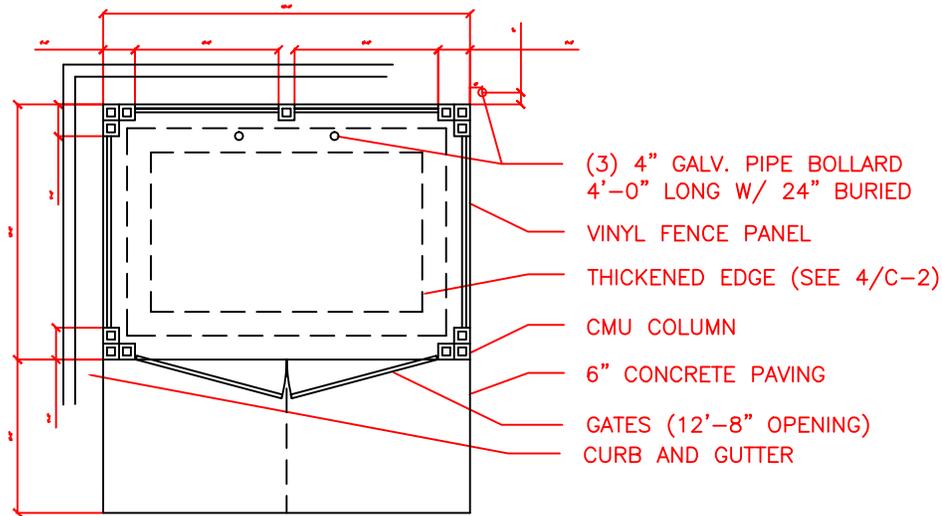
SACRIFICIAL ANODE VERTICAL INSTALLATION

NO SCALE



Malmstrom AFB
Standard Drawings

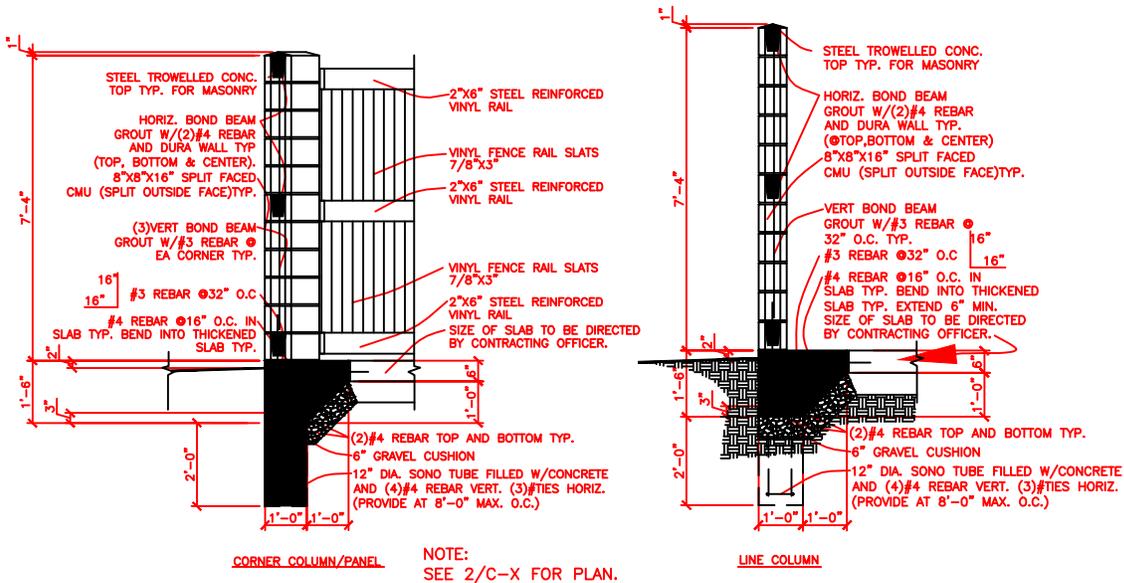
SACRIFICIAL ANODE
VERTICAL ALIGNMENT



2
C-X

DUMPSTER ENCLOSURE

NTS



1
C-X

DUMPSTER ENCLOSURE

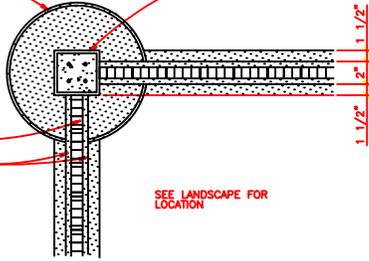
NTS

Malmstrom AFB
Standard Drawings

VINYL DUMPSTER
ENCLOSURE

12" DIA. SONOTUBE FOR CONCRETE FOOTING
SEE PLAN FOR ALL LOCATIONS

7/8"x3" VINYL FENCE RAIL SLATS
2"x6" STEEL REINFORCED VINYL RAIL BELOW



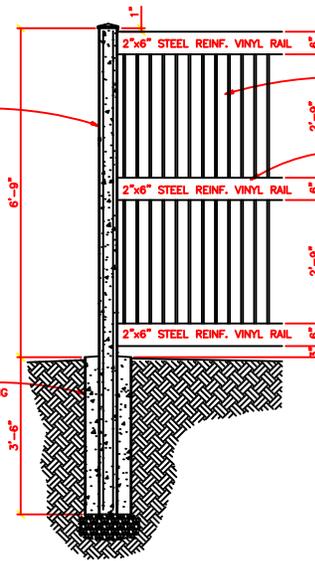
X VINYL WALL DETAIL
X
NTS

5"x5" STEEL REINFORCED VINYL POST—PROVIDE 4-#3 BARS AND FILL WITH CONCRETE

1 1/2"
2"
1 1/2"

SEE LANDSCAPE FOR LOCATION

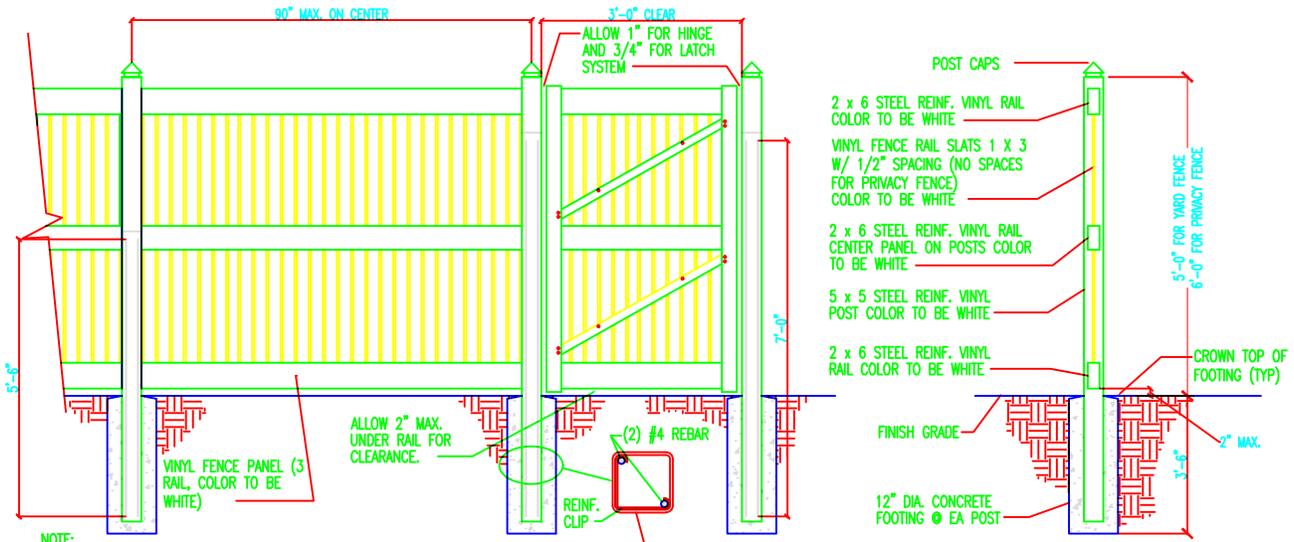
12" DIA. SONOTUBE FOR CONCRETE FOOTING



X VINYL WALL DETAIL
X
NTS

Malmstrom AFB
Standard Drawings

VINYL FENCE



NOTE:

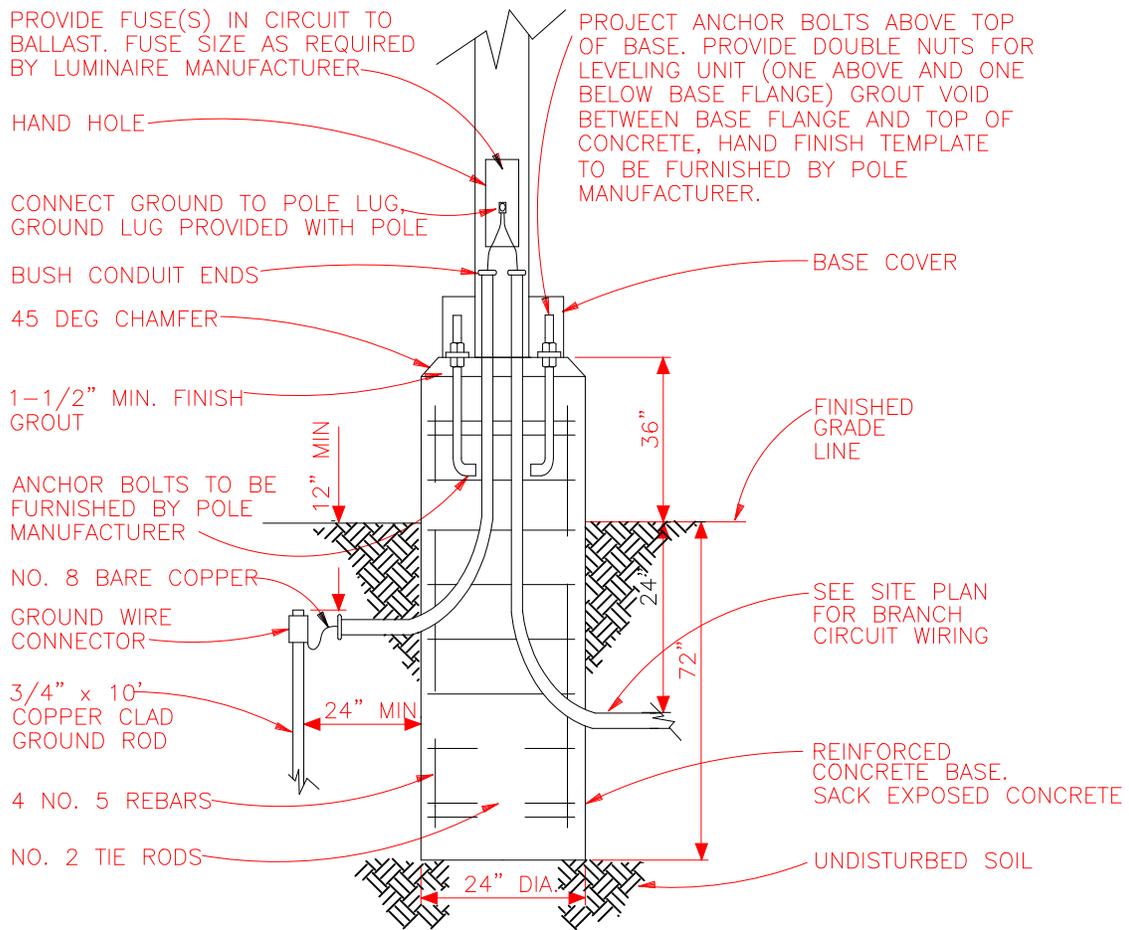
1. ALL DIMENSIONS OF VINYL MATERIALS ARE NOMINAL.
2. VERTICAL POST REINFORCEMENT SHALL BE 5'-0" FOR CORNER & END POSTS, AND 6'-6" FOR HINGE & LATCH POSTS. INTERMEDIATE POSTS SHALL USE METAL STIFFENERS, PER MANUFACTURER'S RECOMMENDATIONS, IN LIEU OF CONCRETE REINFORCEMENT.
3. BLOCK ENDS OF BOTTOM & MID RAILS AS REQUIRED TO PREVENT CONCRETE FLOW INTO THE RAILS DURING CONCRETING OF POSTS.
4. WHERE FENCE RETURNS TO BUILDING WALL OR PATIO COLUMN, ALLOW 2" CLEARANCE FOR POST. DO NOT ATTACH TO SIDING OR FACE OF COLUMN.

(2) #4 REBAR VERT., IN ALL POSTS. POSITION REBAR IN OPPOSING CORNERS OF EA POST. USE REBAR SEPARATOR CLIPS TO HOLD REBAR (TYP). FILL POST WITH CONCRETE.

SECTION

Malmstrom AFB
Standard Drawings

VINYL FENCE
PANEL & GATE

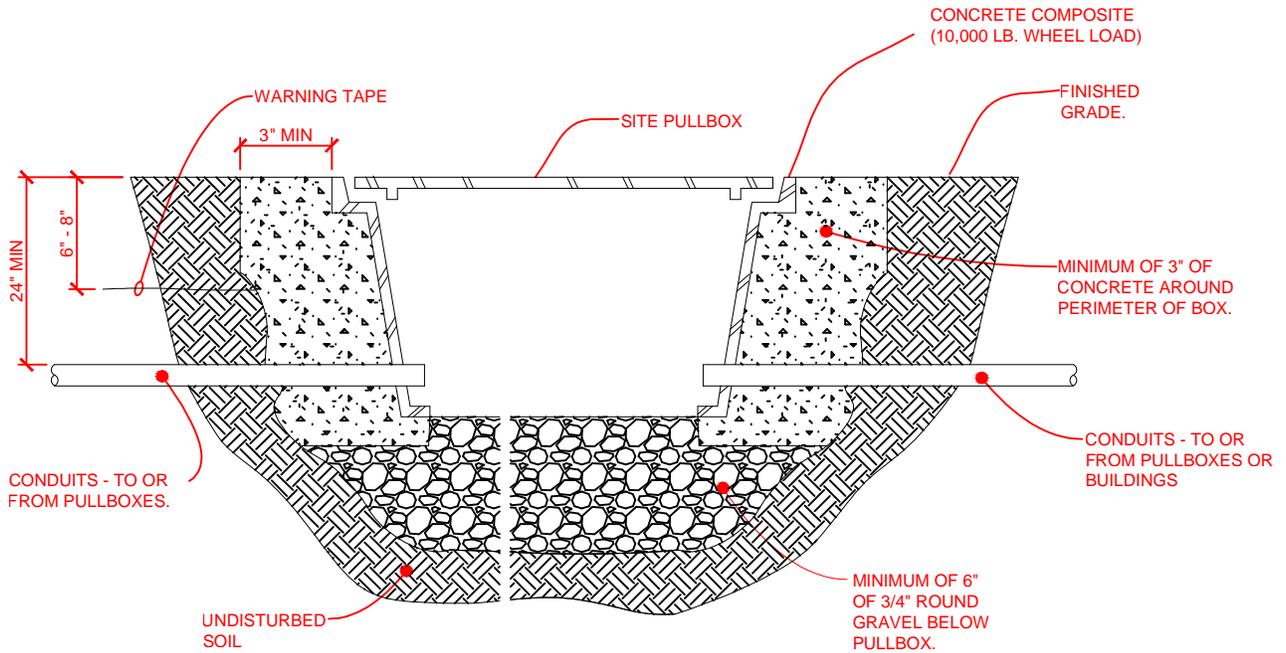


POLEBASE DETAIL-ASPHALT AREAS

SCALE: NONE

Malmstrom AFB
Standard Drawings

ELECTRICAL POLE
BASE DETAIL

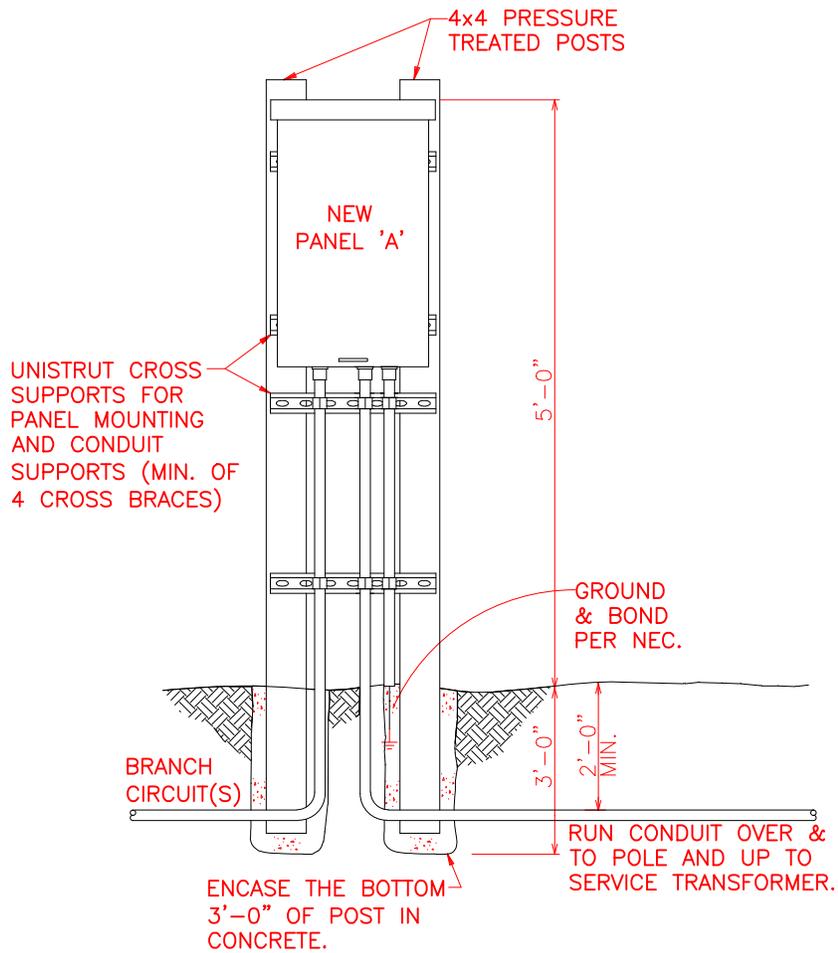


TYPICAL SITE PULLBOX

SCALE: NONE

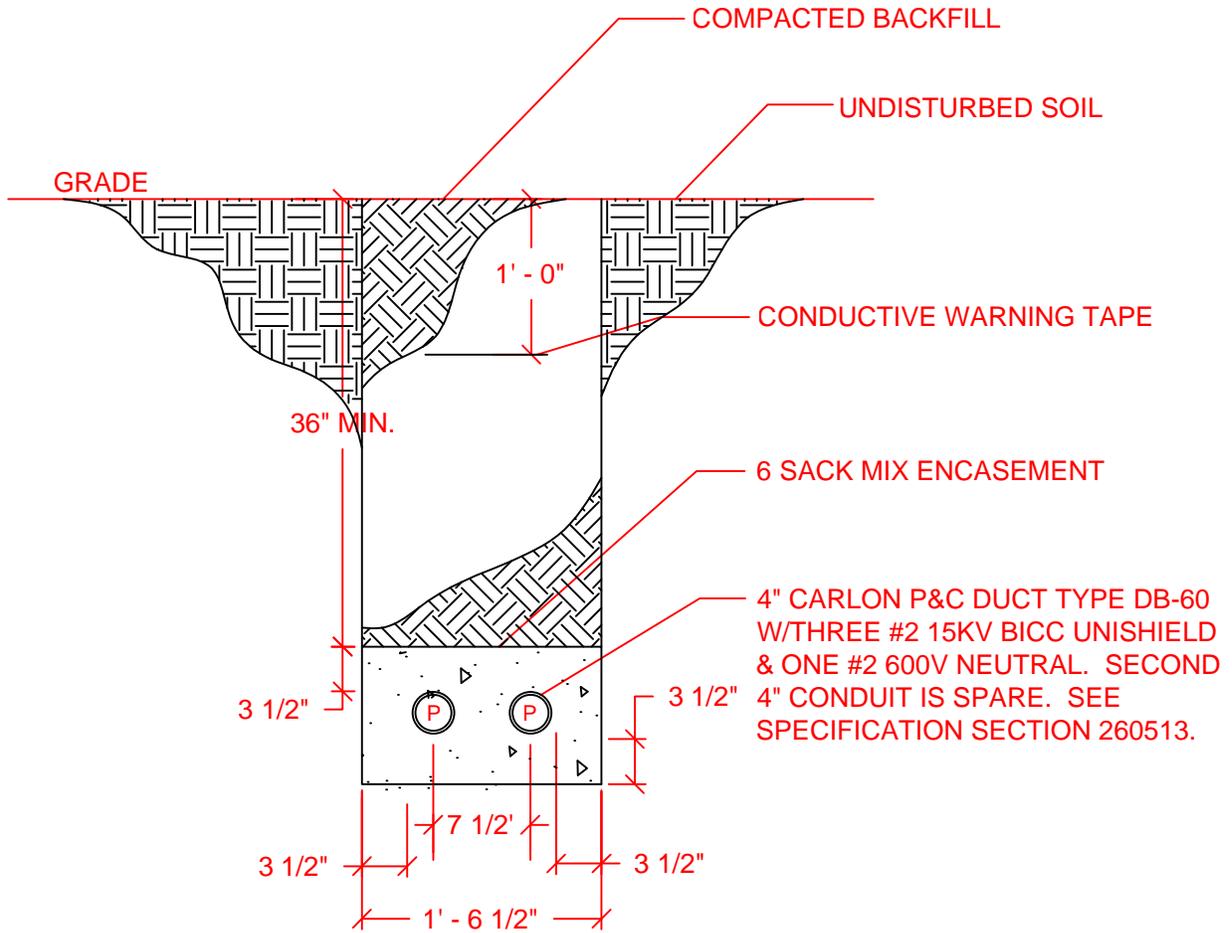
Malmstrom AFB
Standard Drawings

PULL BOX DETAIL



PANEL MOUNTING DETAIL

SCALE: NONE

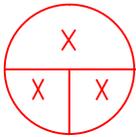


NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. MAINTAIN 12" CLEARANCE FROM OTHER UTILITIES.
3. 6 SACK MIX ENCASEMENT TO BE DYED RED.

ENGINEERS NOTE

1. CHANGE CONDUIT AND WIRE SIZE AS NECESSARY.



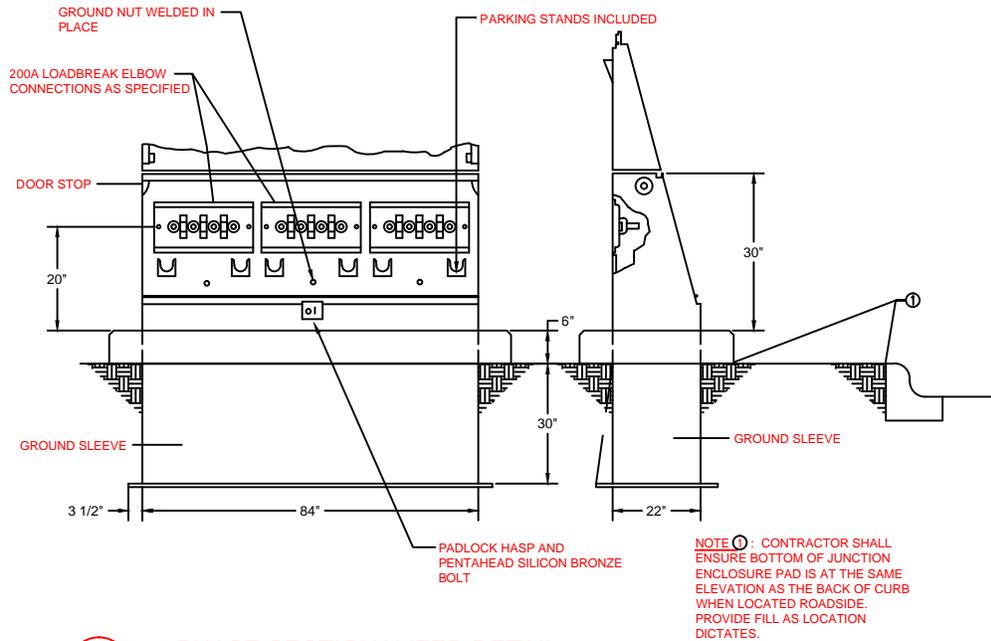
CONCRETE DUCTBANK SECTION

ELECTRICAL PRIMARY

SCALE: 3/4" = 1'-0"

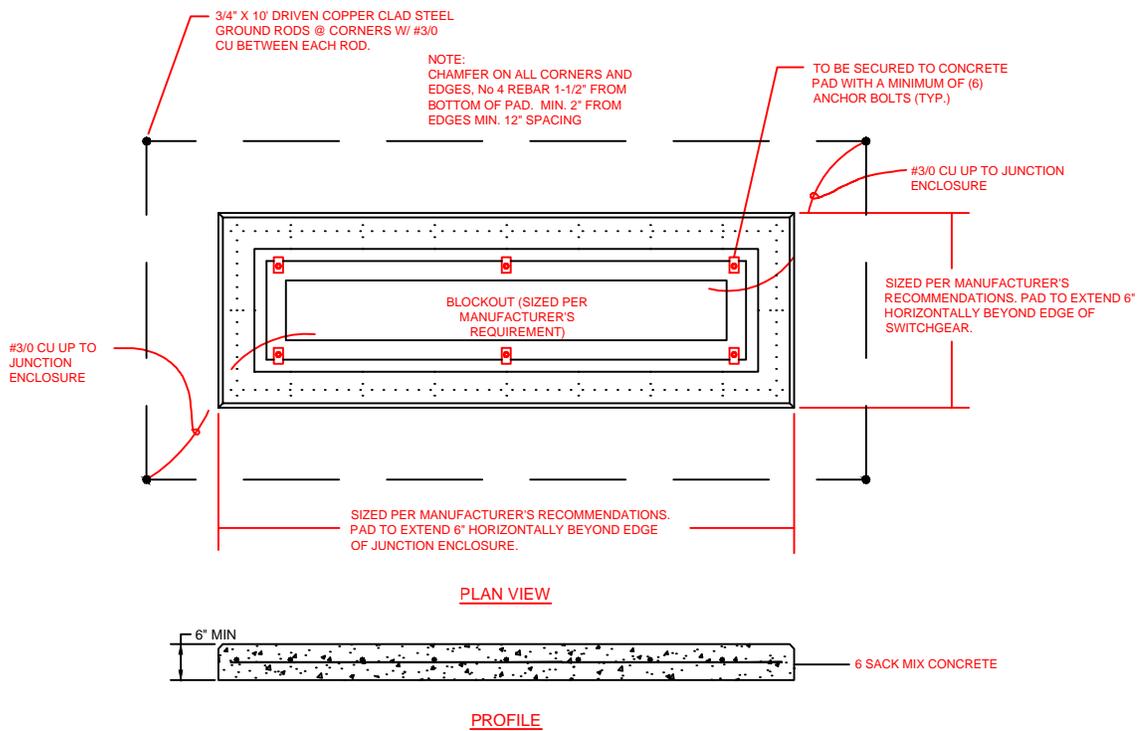
Malmstrom AFB
Standard Drawings

HIGH VOLTAGE
CONCRETE DUCT BANK
7200V/12470V



3 PHASE SECTIONALIZER DETAIL

SCALE: NONE



TYP. SECTIONALIZER CONCRETE PAD DETAIL

SCALE: NONE

FINISHED CEILING



TOP OF DEVICE



CENTER OF DEVICE

AC = ABOVE COUNTER, MINIMUM 4" ABOVE COUNTERTOP OR BACKSPLASH TO BOTTOM OF DEVICE. UNLESS NOTED OTHERWISE.



CENTER OF DEVICE

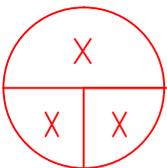
1'-6"

44"

74" TO TOP OF TRIM

80" AFF TO BOTTOM OF DEVICE OR 6" BELOW CEILING TO TOP OF DEVICE, WHICHEVER IS LOWER

FINISHED FLOOR



MOUNTING HEIGHTS DETAIL

SCALE: NONE

Malmstrom AFB
Standard Drawings

MOUNTING HEIGHT
DETAILS

NOTE:

ALL DIMENSIONS MAY VARY WITH MANUFACTURER AND SIZE OF TRANSFORMER. CONTRACTOR SHALL VERIFY ALL DIMENSIONS & BLOCKOUTS SIZES WITH MANUFACTURER RECOMMENDATIONS PRIOR TO POUR. CONCRETE PAD TO EXTEND 6" HORIZONTALLY BEYOND OUTSIDE EDGE OF TRANSFORMER.

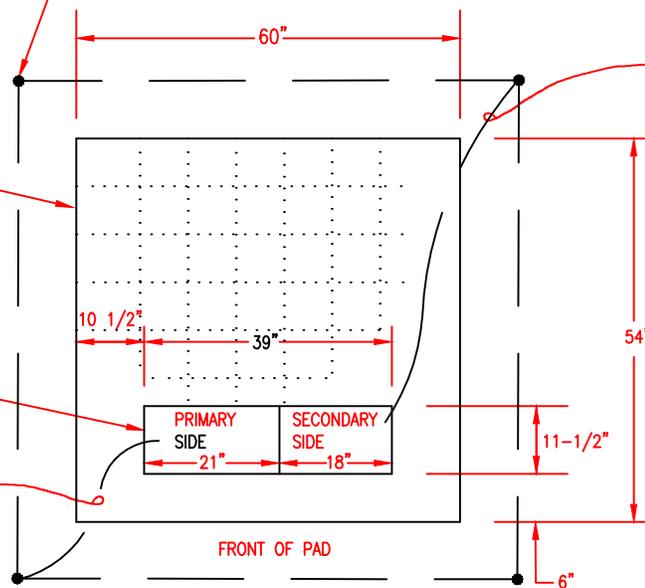
6" THICK CONC. PAD
(6 1/2 SACK MIX)
REINFORCE W/ 12"
GRID OF #4 REBAR.
SEE CONCRETE SPEC
FOR DUCTBANK
ENCASEMENT.

BLOCK-OUT, VERIFY
LOCATION & SIZE OF
OPENING WITH MFR.'S
RECOMMENDATION

#3/0 CU. UP
TO TRANSFORMER

3/4" X 10' DRIVEN COPPER CLAD STEEL GROUND ROD
⊗ CORNER W/ #3/0 CU BETWEEN EACH ROD.

#3/0 CU. UP
TO TRANSFORMER



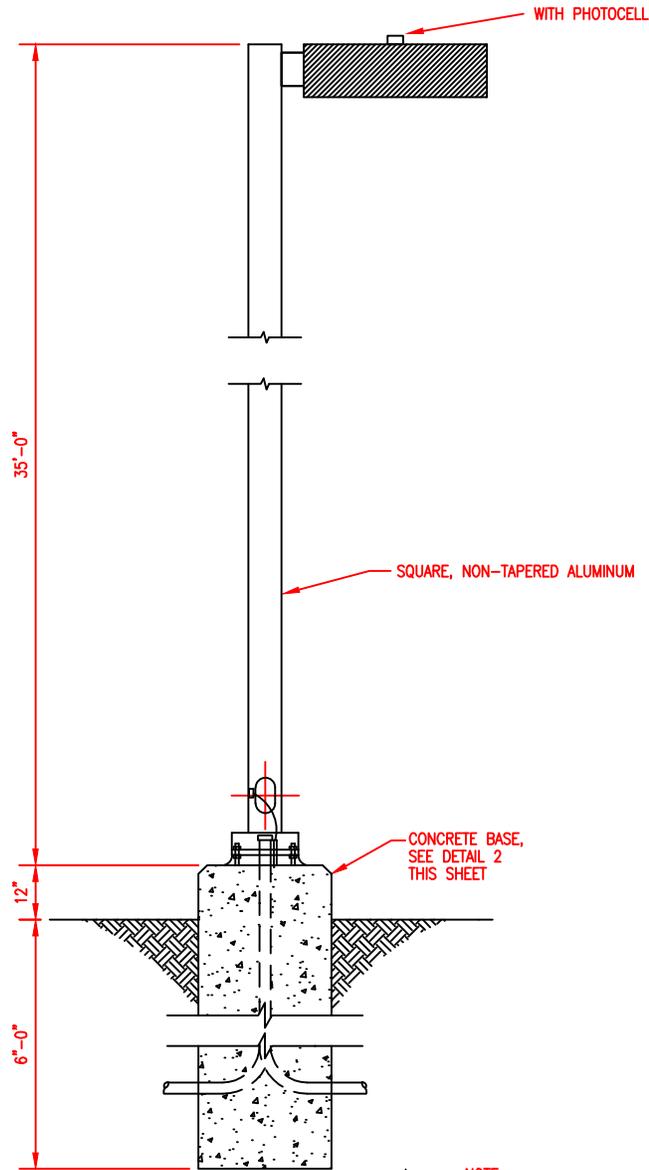
TYPICAL TRANSFORMER PAD & GROUNDING DETAIL

7

NO SCALE

Malmstrom AFB
Standard Drawings

TRANSFORMER PAD
DETAILS



NOTE:
 SUPPLY KIM #5SQ-115/DB-A/A25
 LIGHT FIXTURES IN QUANTITIES
 NOTED ON PLANS.

GENERAL NOTES:

1. PROVIDE CIRCUIT PROTECTION (FUSING) PER MANUF. RECOMMENDATIONS.
2. CONTRACTOR SHALL COMPLETE STREET LIGHTING CIRCUIT (INCL. CONDUIT AND CONDUCTOR) UP TO LV SIDEWALK BOX. AN ADDITIONAL 20 FEET OF CONDUCTOR SHALL BE LEFT IN THE SIDEWALK BOX FOR FUTURE POLE BASE.

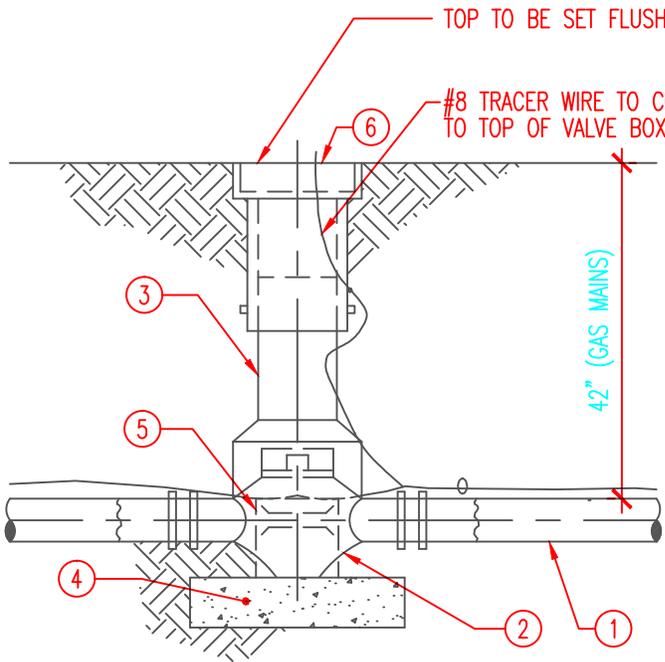
STREET LIGHT FIXTURE DETAIL

2

NO SCALE

Malmstrom AFB
 Standard Drawings

STREET LIGHT FIXTURE
 DETAILS



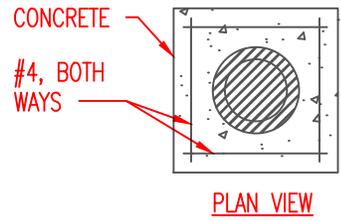
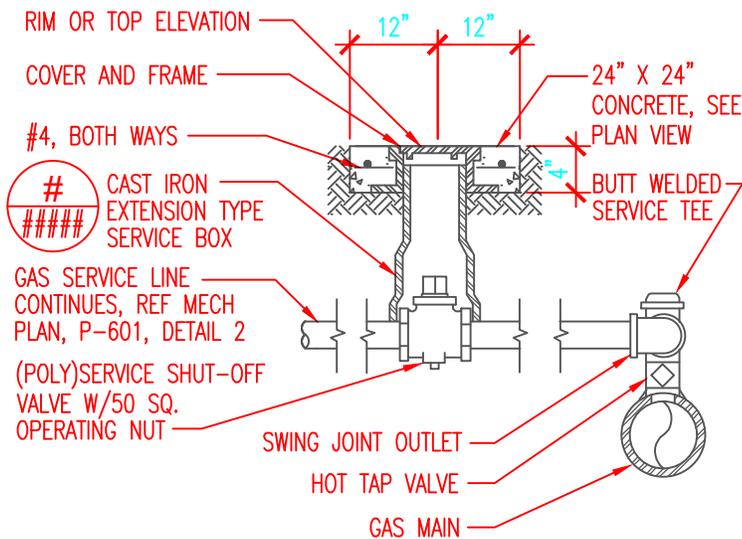
NOTES:

- ①. 1 PLASTIC DISTRIBUTION MAIN
- ②. PLASTIC VALVE
- ③. CAST IRON LOCKING VALVE BOX
- ④. 2"x18"x18" CONCRETE BLOCK
- ⑤. 2"x12" CONCRETE BLOCK - 2 EA. (HEIGHT AS REQUIRED TO SUPPORT VALVE BOX)
- ⑥. PAINT VALVE BOX LID BRIGHT YELLOW AND THE WORD "GAS" SHALL BE LETTERED IN THE COVER

GAS VALVE BOX

Malmstrom AFB
Standard Drawings

GAS VALVE BOX

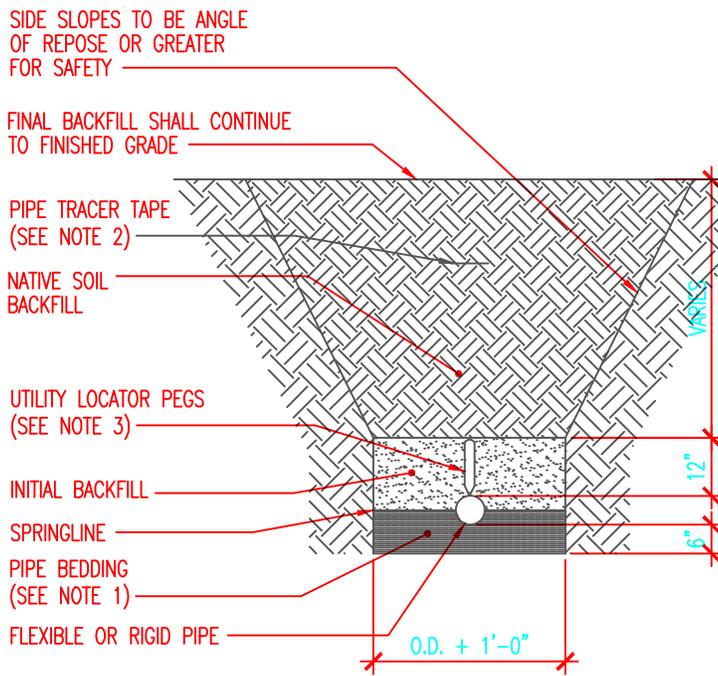


- NOTES:
1. CONCRETE COLLAR NOT REQUIRED IF VALVE IS LOCATED IN PAVED AREA OR CONCRETE SIDEWALK/SLAB.
 2. LINE SIZES AS CALLED OUT ON UTILITY PLANS.

TYPICAL GAS SERVICE CONNECTION

Malmstrom AFB
Standard Drawings

GAS SERVICE
CONNECTION



NOTES:

1. GRANULAR BEDDING FOR UTILITY PIPES SHALL CONSIST OF MATERIAL MEETING THE FOLLOWING GRADATION REQUIREMENTS: 100% BY WEIGHT PASSING THE 1" SIEVE, 40% TO 80% BY WEIGHT PASSING THE NO.4 SIEVE; AND 8% TO 15% BY WEIGHT PASSING THE NO. 200 SIEVE, OR AS RECOMMENDED BY THE UTILITY PIPE MANUFACTURER. MATERIAL SHALL BE NON-PLASTIC (P<6).
2. ALL UTILITY LINES SHALL HAVE METALLIC MARKER TAPE INSTALLED 2'-6" BELOW FINISHED GRADE ALONG THE CENTERLINE OF INSTALLED PIPE. GAS AND WATER LINES SHALL ALSO HAVE A #8 TRACER WIRE TAPED TO THE PIPE. MARKER TAPE AND TRACER WIRE MUST COME UP AT VALVE BOXES.
3. LOCATOR PEGS SHOULD BE PLACED AT 50-FOOT INTERVALS ON STRAIGHT-LINE UTILITY RUNS AND AT EVERY UTILITY BEND OR TEE CONNECTION. LOCATOR PEGS SHALL BE PLACED DIRECTLY ON THE UTILITY IN THE VERTICAL POSITION. MAXIMUM DEPTH OF READING FOR UTILITY PEGS IS 9'-0". IF UTILITY IS DEEPER THAN 9'-0", MEASURED FROM TOP OF UTILITY TO FINISHED GRADE, PLACE UTILITY LOCATOR PEG AT 9'-0" IN THE VERTICAL POSITION.

GAS LINE TRENCH

Malmstrom AFB
Standard Drawings

GAS LINE TRENCH



ASPHALT CONCRETE PAVEMENT

PIPE TRACER TAPE (SEE NOTE 3)

NATIVE SOIL BACKFILL

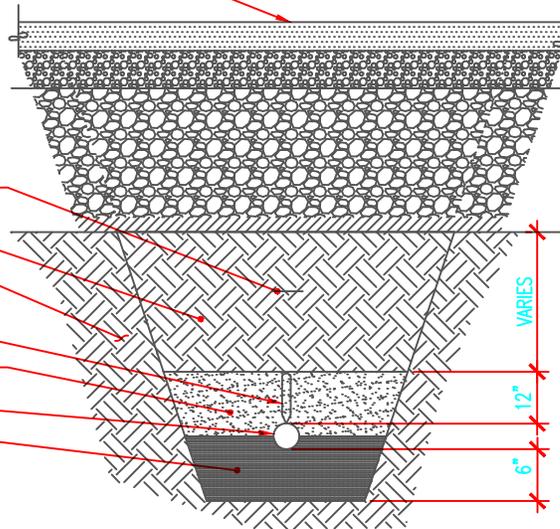
UNDISTURBED NATIVE SOIL

UTILITY LOCATOR PEG (SEE SPEC SECTION 31 00 00.02)

INITIAL BACKFILL COMPACT TO 90%

FLEXIBLE PIPE

PIPE BEDDING (SEE NOTE 1)



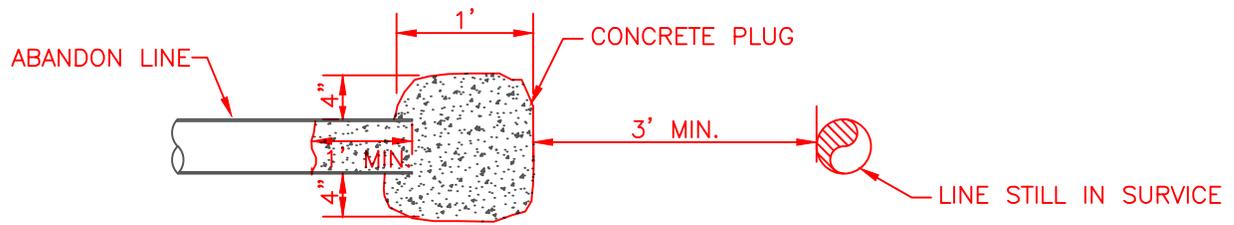
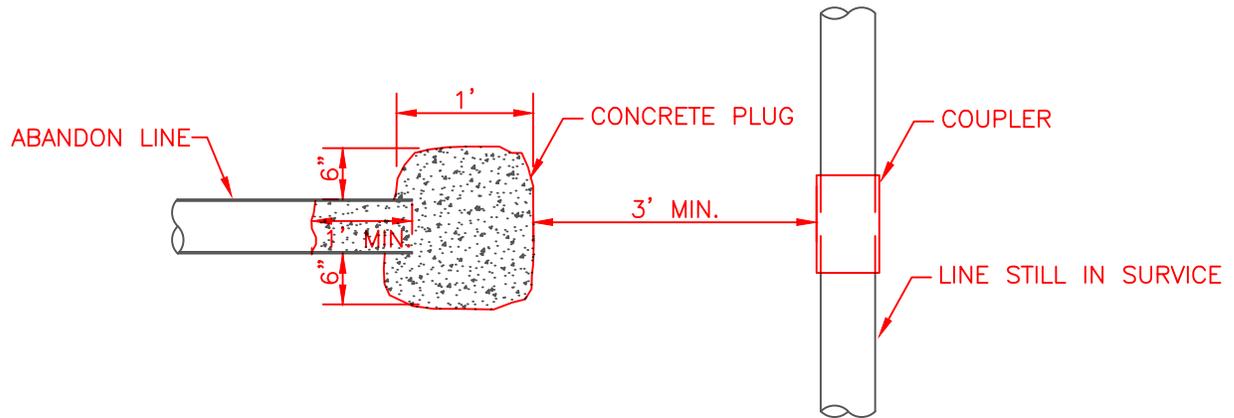
NOTES:

1. GRANULAR BEDDING FOR UTILITY PIPES SHALL CONSIST OF MATERIAL MEETING THE FOLLOWING GRADATION REQUIREMENTS: 100% BY WEIGHT PASSING THE 1" SIEVE, 40% TO 80% BY WEIGHT PASSING THE NO.4 SIEVE; AND 8% TO 15% BY WEIGHT PASSING THE NO. 200 SIEVE, OR AS RECOMMENDED BY THE UTILITY PIPE MANUFACTURER. MATERIAL SHALL BE NON-PLASTIC (PI<6).
2. IN PAVED AREAS TOP 8" OF CLASSIFIED FILL MATERIAL SHALL BE COMPACTED TO 95% PER ASTM 1557.
3. ALL UTILITY LINES SHALL HAVE METALLIC MARKER TAPE INSTALLED 2'-6" BELOW FINISHED GRADE ALONG THE CENTERLINE OF INSTALLED PIPE. GAS AND WATER LINES SHALL ALSO HAVE A #8 TRACER WIRE TAPED TO THE PIPE. MARKER TAPE AND TRACER WIRE MUST COME UP AND BE SECURED AT VALVE BOXES.

UTILITY TRENCH BELOW PAVEMENT

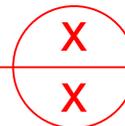
Malmstrom AFB
Standard Drawings

UTILITY TRENCH
IN ASPHALT



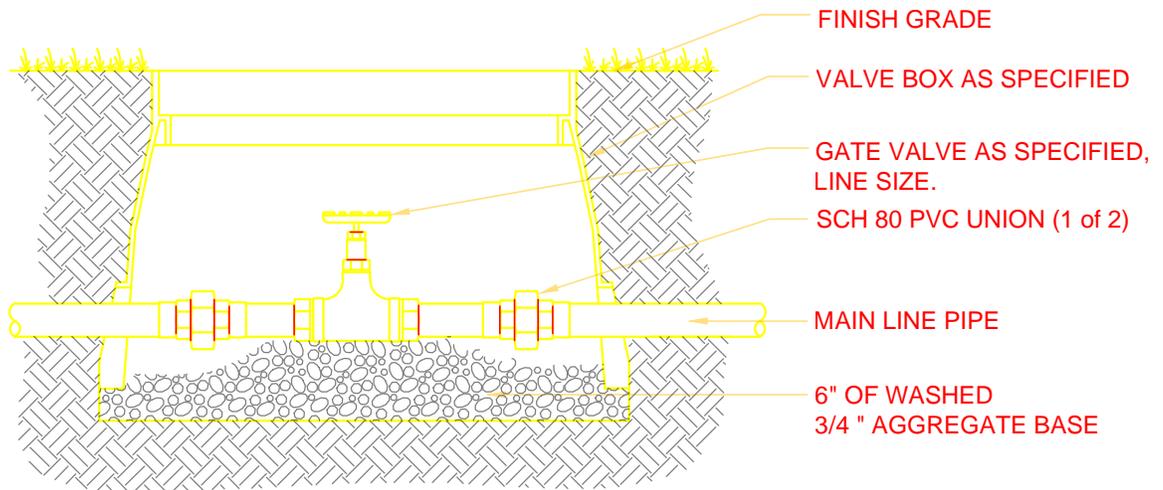
PLUG AND ABANDON LINE DETAIL

NO SCALE



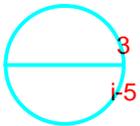
Malmstrom AFB
Standard Drawings

PLUG & ABANDON
GAS LINE



NOTE:

1. VALVE TO BE SUPPORTED BY GRAVEL, PROVIDE BLOCK SHIM AS REQUIRED.

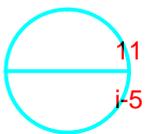
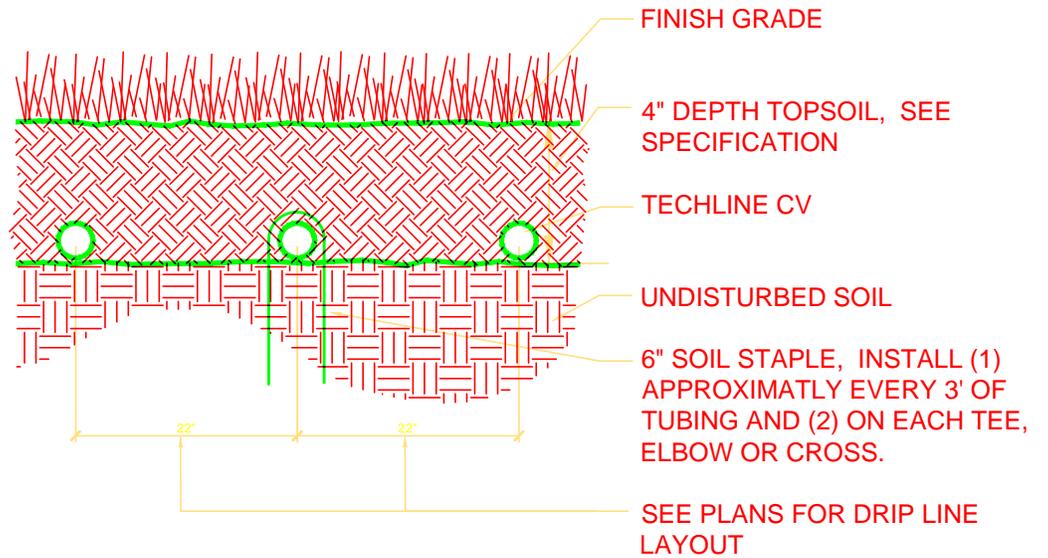


ISOLATION VALVE DETAIL

SCALE: NOT TO SCALE

Malmstrom AFB
Standard Drawings

ISOLATION VALVE BOX

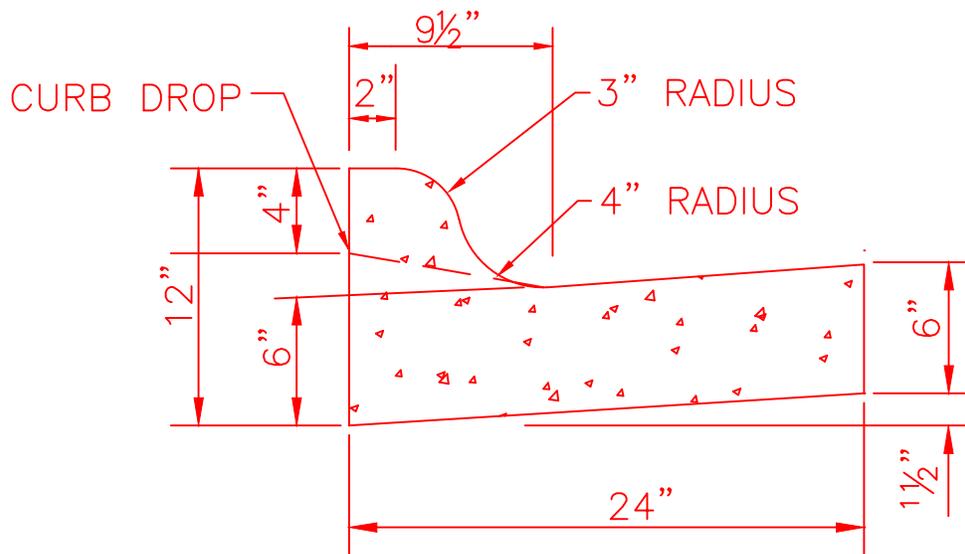


SUBSURFACE DRIP INSTALLATION DETAIL

SCALE: 3/4"=1'0"

Malmstrom AFB
Standard Drawings

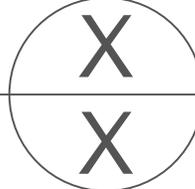
SUBSURFACE DRIP
INSTALLATION



CATCH TYPE

NOTES:

1. CONTRACTION JOINTS CUT AT 10 FOOT INTERVALS.
2. EXPANSION JOINTS AT 50 FOOT INTERVALS.
3. ROUND ALL SIDE EDGES AND JOINT EDGES WITH EDGING TOOL.
4. THE TRANSITION LENGTH BETWEEN A NORMAL CURB SECTION AND A DROP CURB SECTION SHALL BE 5'-0", UNLESS NOTED OTHERWISE.

DETAIL 

NO SCALE

Malmstrom AFB
Standard Drawings

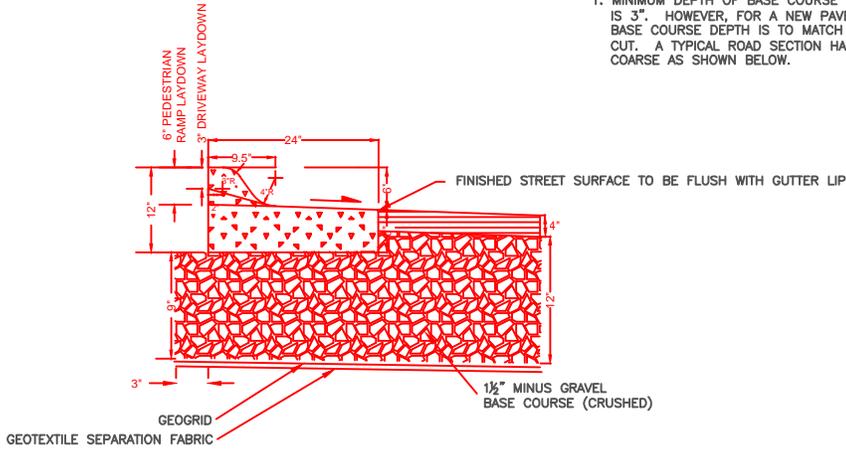
CURB DETAILS

NOTE:

1. INSTALL 4000 PSI CONCRETE.
2. BROOM FINISH CURB SURFACE. ROUND ALL SIDE EDGES & JOINT EDGES WITH EDGING TOOL.
3. CONTRACTION JOINTS CUT AT 10' O.C.
4. EXPANSION JOINTS AT 50' INTERVALS
5. THE TRANSITION LENGTH BETWEEN A NORMAL CURB SECTION AND A DROP CURB SECTION SHALL BE 3'-0".
6. EXTEND GEOTEXTILE AND GEOGRID TO 3" BEHIND BACK OF CURB.
7. EXTEND GRAVEL TO THE EDGE OF THE EXCAVATION. GRAVEL EXTENSION BEYOND THE EDGE OF THE FABRIC WILL BE AT NO ADDITIONAL COST TO THE GOVERNMENT.

ENGINEERS NOTE:

1. MINIMUM DEPTH OF BASE COURSE UNDER CURB IS 3". HOWEVER, FOR A NEW PAVEMENT SECTION BASE COURSE DEPTH IS TO MATCH DEPTH OF ROAD CUT. A TYPICAL ROAD SECTION HAS 12" BASE COARSE AS SHOWN BELOW.



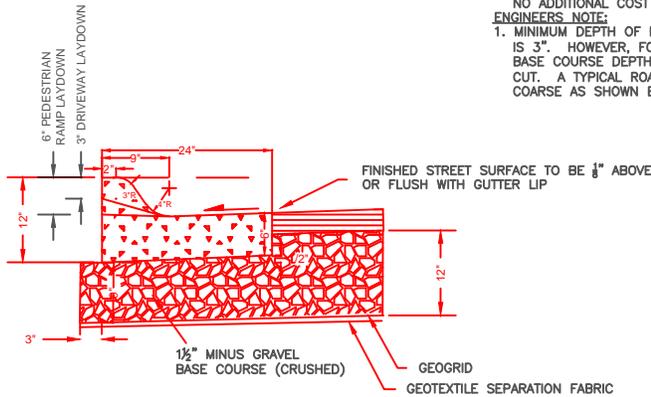
SPILL CURB SECTION
NO SCALE

NOTE:

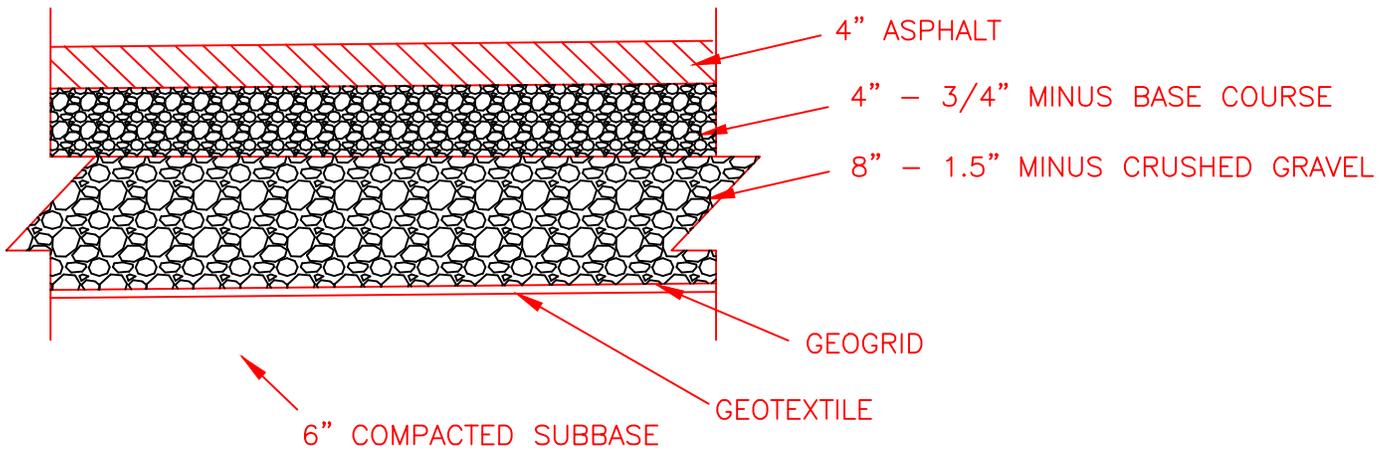
1. INSTALL 4000 PSI CONCRETE.
2. BROOM FINISH CURB SURFACE. ROUND ALL SIDE EDGES & JOINT EDGES WITH EDGING TOOL.
3. CONTRACTION JOINTS CUT AT 10' O.C.
4. EXPANSION JOINTS AT 50' INTERVALS
5. THE TRANSITION LENGTH BETWEEN A NORMAL CURB SECTION AND A DROP CURB SECTION SHALL BE 3'-0".
6. EXTEND GEOTEXTILE AND GEOGRID TO 3" BEHIND BACK OF CURB.
7. EXTEND GRAVEL TO THE EDGE OF THE EXCAVATION. GRAVEL EXTENSION BEYOND THE EDGE OF THE FABRIC WILL BE AT NO ADDITIONAL COST TO THE GOVERNMENT.

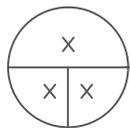
ENGINEERS NOTE:

1. MINIMUM DEPTH OF BASE COURSE UNDER CURB IS 3". HOWEVER, FOR A NEW PAVEMENT SECTION BASE COURSE DEPTH IS TO MATCH DEPTH OF ROAD CUT. A TYPICAL ROAD SECTION HAS 12" BASE COARSE AS SHOWN BELOW.



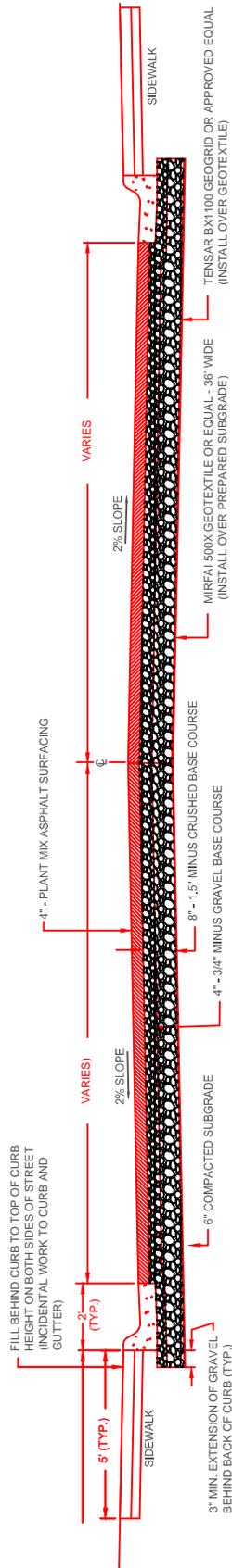
STANDARD CURB DETAIL
NO SCALE




 PAVEMENT SECTION
 NO SCALE

Malmstrom AFB
 Standard Drawings

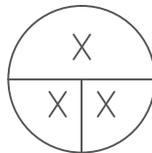
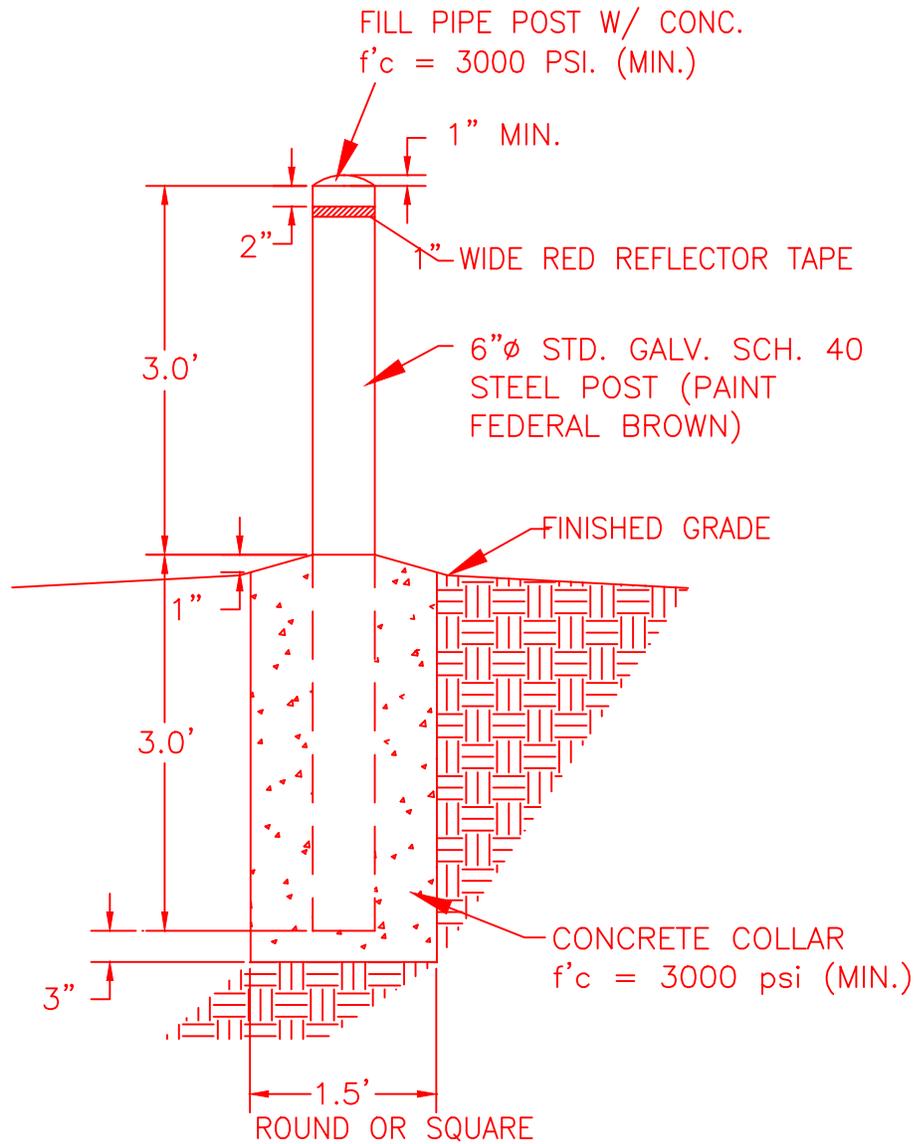
PAVEMENT SECTION



TYPICAL PAVEMENT SECTION

Malmstrom AFB
Standard Drawings

TYPICAL ROAD SECTION



BOLLARD DETAIL

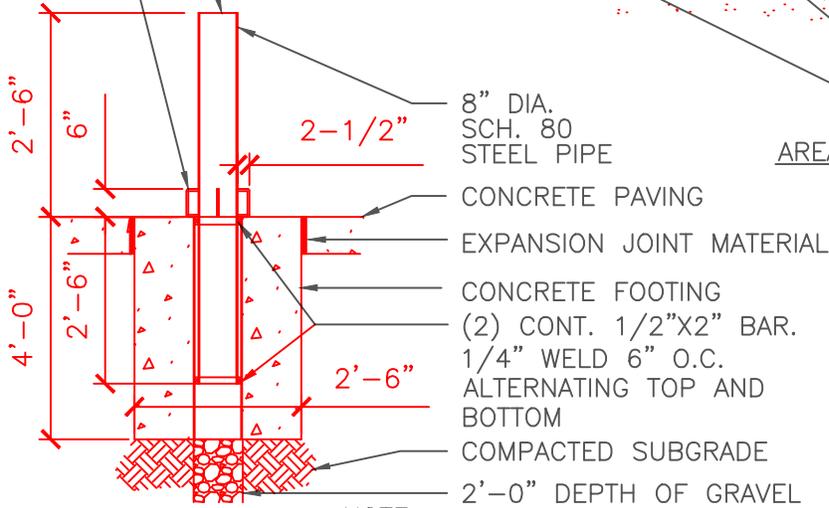
NO SCALE

Malmstrom AFB
 Standard Drawings

BOLLARD DETAILS

WELD ALL-AROUND
1/4" STEEL CAP

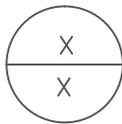
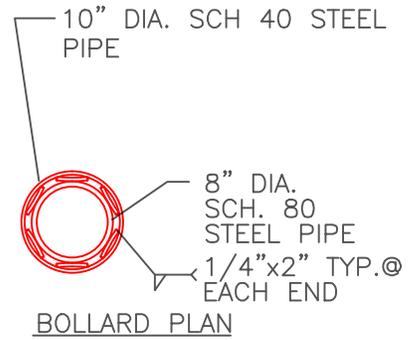
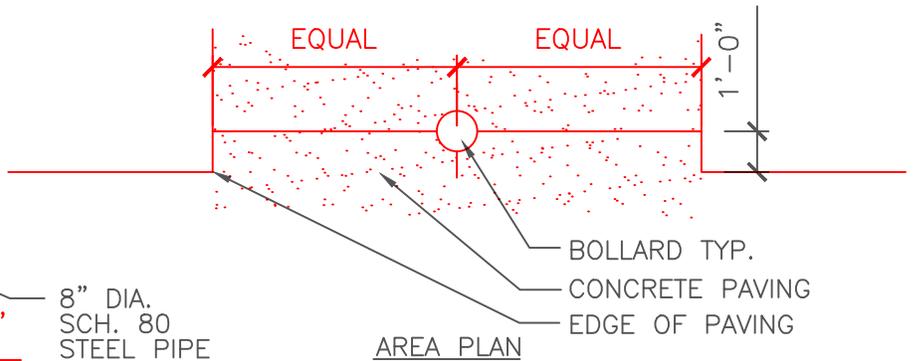
BENT 1/2" DIA.
ROD (WELD TO
PIPE)



SECTION

NOTE:

1. FINISH W/ PRIME AND PAINT.
2. MAKE BOLLARD FIT IN SLEEVE SNUG, BUT NOT UN-REMOVABLE. USE DIFFERENT BAR STOCK AS REQUIRED.



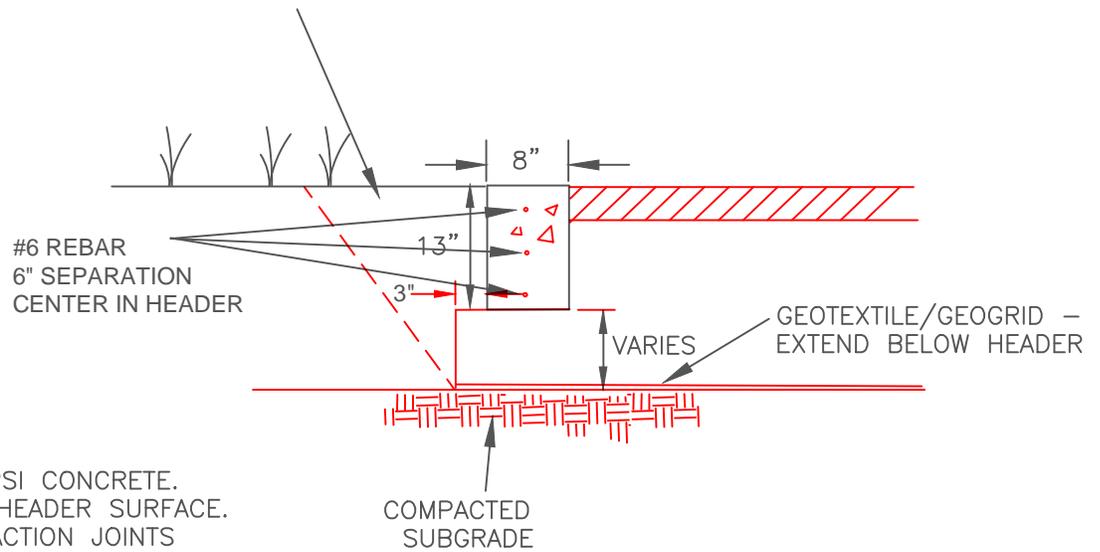
REMOVABLE BOLLARD

NTS

Malmstrom AFB
Standard Drawings

REMOVABLE BOLLARD

COMPACTED FILL BEHIND HEADER TO THE TOP OF CONCRETE.



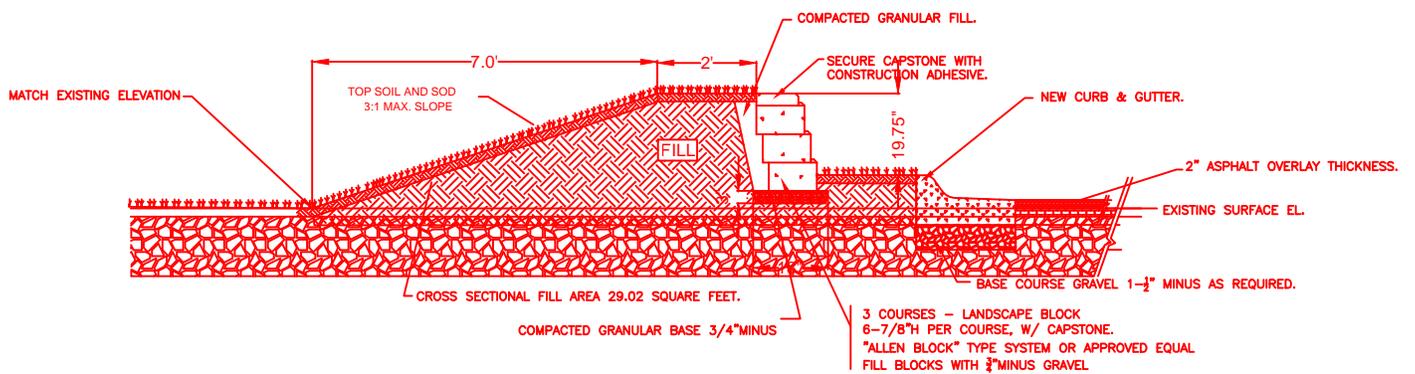
HEADER NOTES:

1. INSTALL 4000 PSI CONCRETE.
2. BROOM FINISH HEADER SURFACE.
3. INSTALL CONTRACTION JOINTS (10' O.C.)

8" CONCRETE HEADER
NO SCALE

Malmstrom AFB
Standard Drawings

CONCRETE HEADER

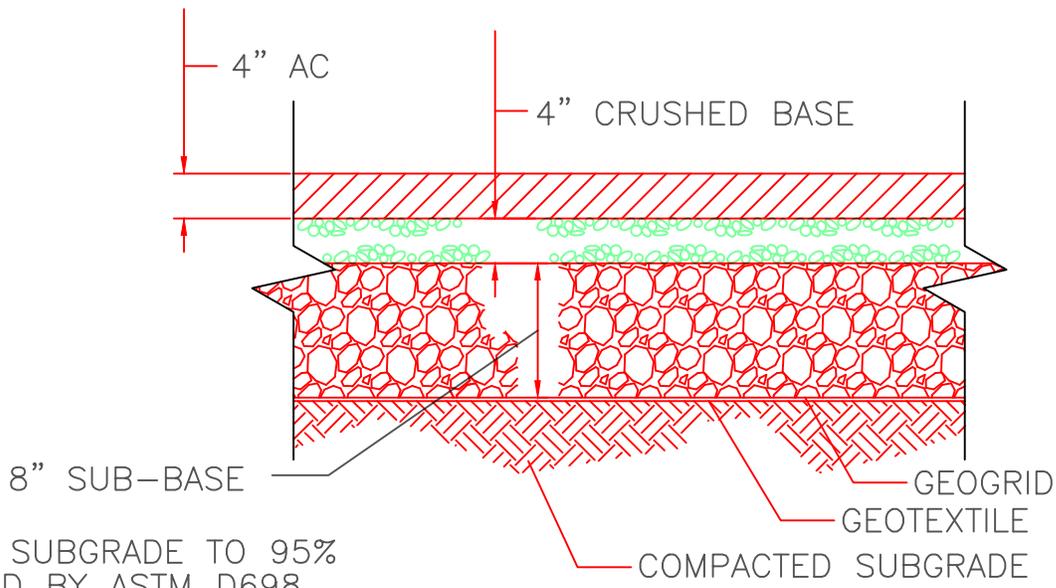


TYPICAL BLOCK AND BERM CROSS SECTION

NO SCALE

Malmstrom AFB
Standard Drawings

FORCE PROTECTION WALL

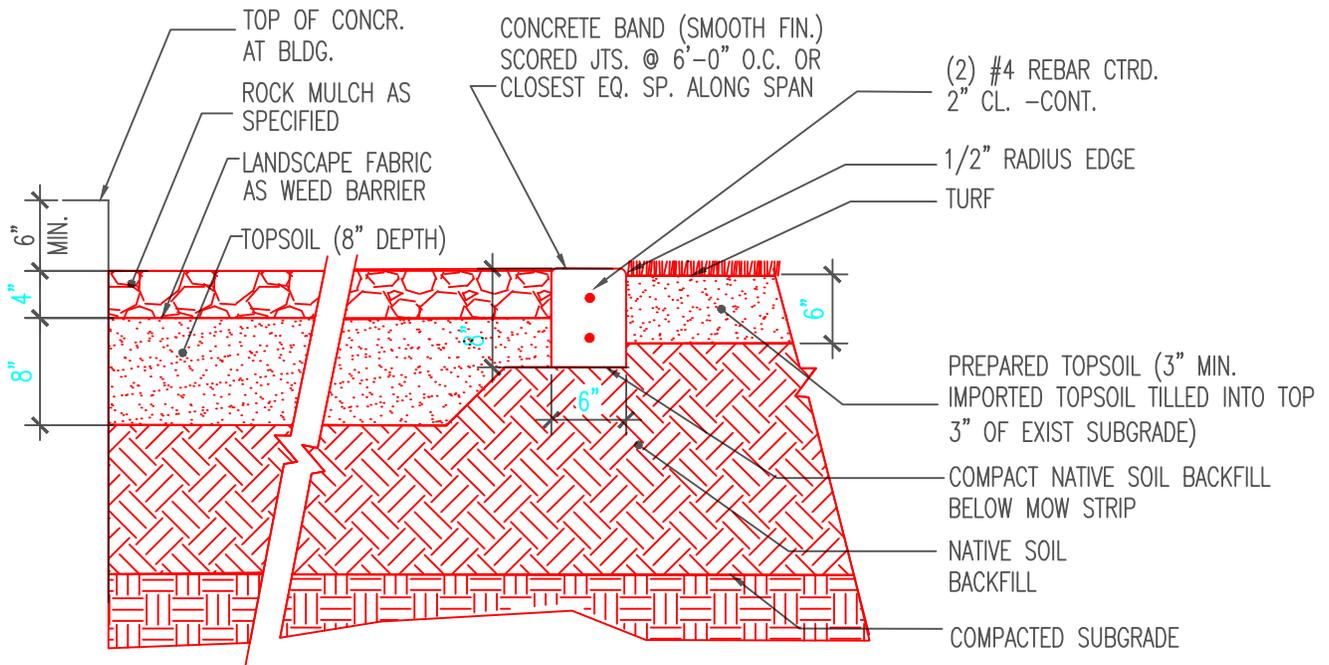


NOTE:
 1. COMPACT ALL SUBGRADE TO 95%
 AS DETERMINED BY ASTM D698

N.T.S.

Malmstrom AFB
 Standard Drawings

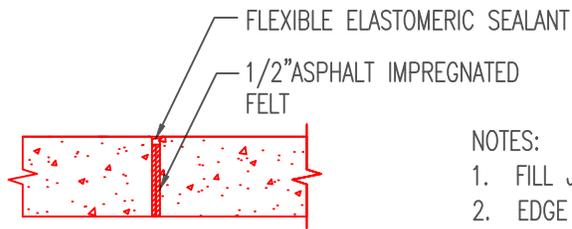
TYPICAL PARKING LOT
 SECTION



(x) CONCRETE MOWSTRIP
 (x)
 NTS

Malmstrom AFB
 Standard Drawings

MOW STRIP DETAIL

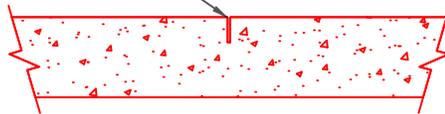


NOTES:

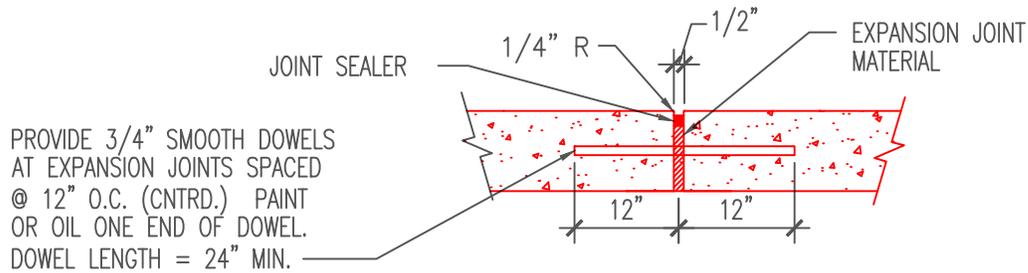
1. FILL JT W/FLEXIBLE ELASTOMERIC SEALANT.
2. EDGE EACH SIDE OF JT WITH 1/4" RADIUS.

ISOLATION JOINT

HAND TOOLED JOINT 1-1/4"
DEEP ROUND EA. SIDE OF JT
W/ 1/4" RADIUS



CONTRACTION JOINT (10'-0" OC ALONG SIDEWALK)



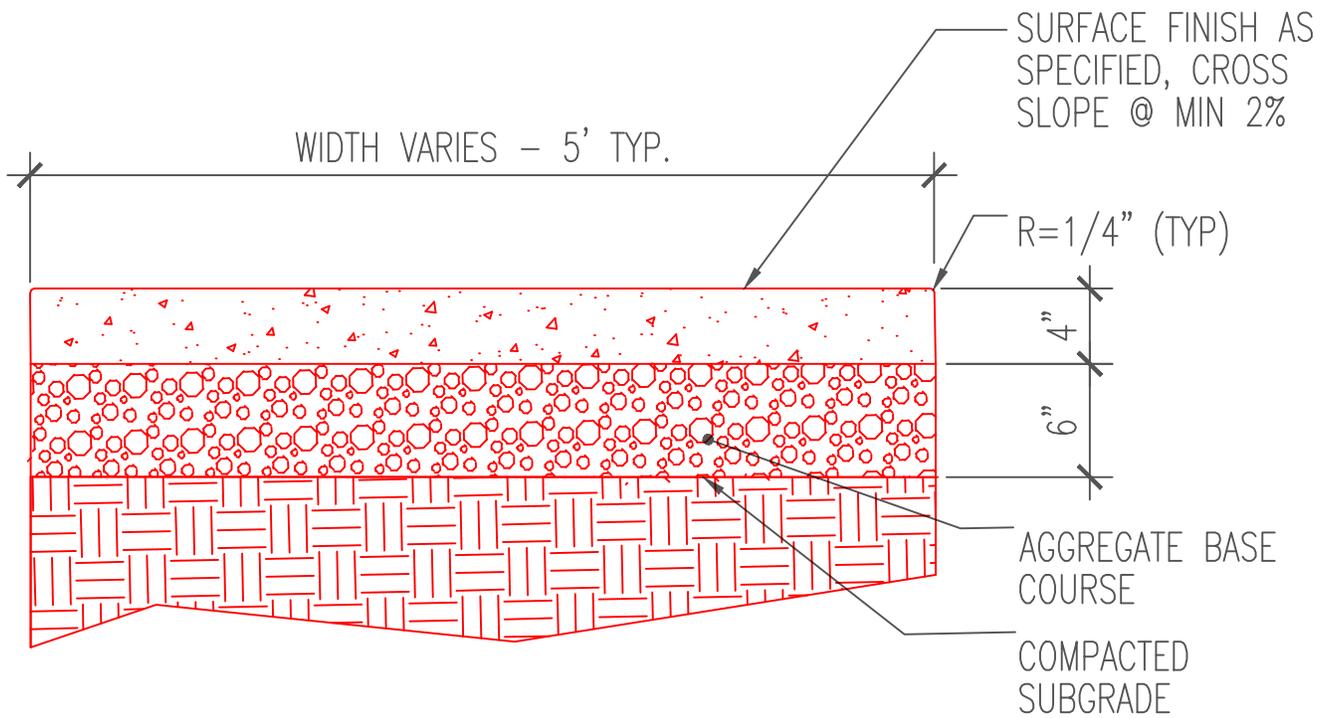
PROVIDE 3/4" SMOOTH DOWELS
AT EXPANSION JOINTS SPACED
@ 12" O.C. (CNTRD.) PAINT
OR OIL ONE END OF DOWEL.
DOWEL LENGTH = 24" MIN.

EXPANSION JOINT (60'-0" OC MAX. ALONG SIDEWALK)

CONCRETE PAVEMENT JOINTS FOR SIDEWALKS

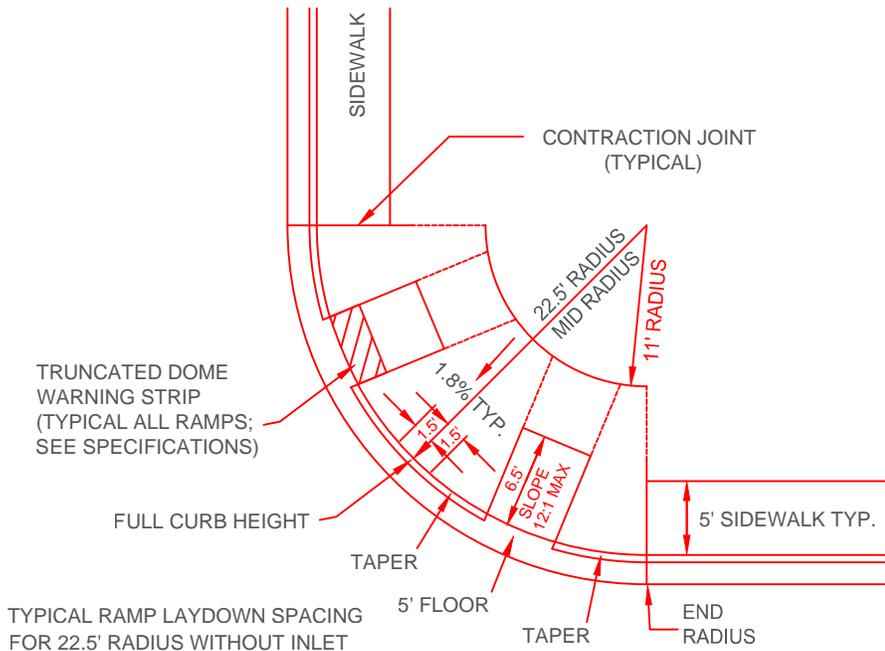
Malmstrom AFB
Standard Drawings

SIDEWALK JOINT
DETAIL

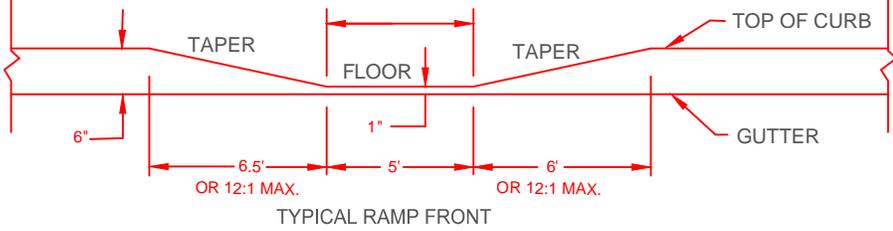


Malmstrom AFB
 Standard Drawings

SIDEWALK DETAIL



MATCH LAYDOWN CROSS SLOPE TO CURB GRADE TO A MAXIMUM OF 2%.
 INSTALL THE 6.5' TAPER ON THE SIDE OF THE FLOOR WITH AN INCREASING CURB GRADE. BEGIN THE TAPER AT THE END OF THE RADIUS



CURB RADIUS LAYDOWN DETAILS

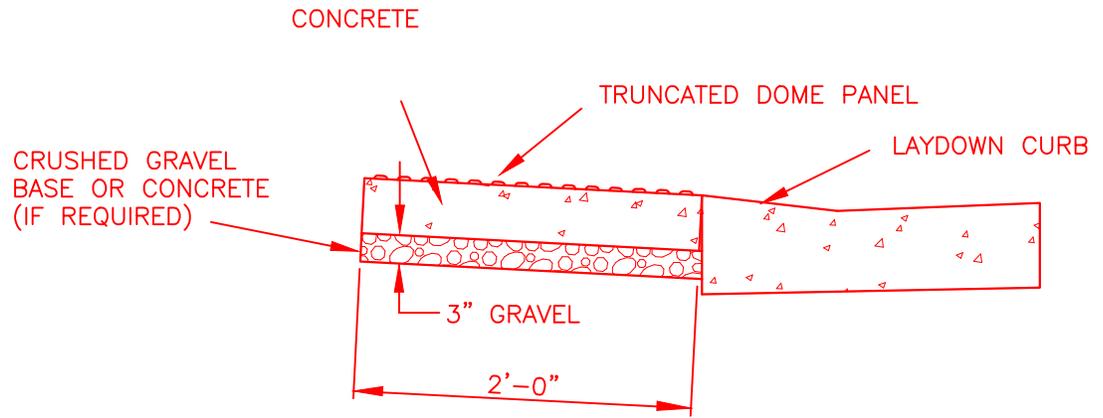
NO SCALE

NOTE:

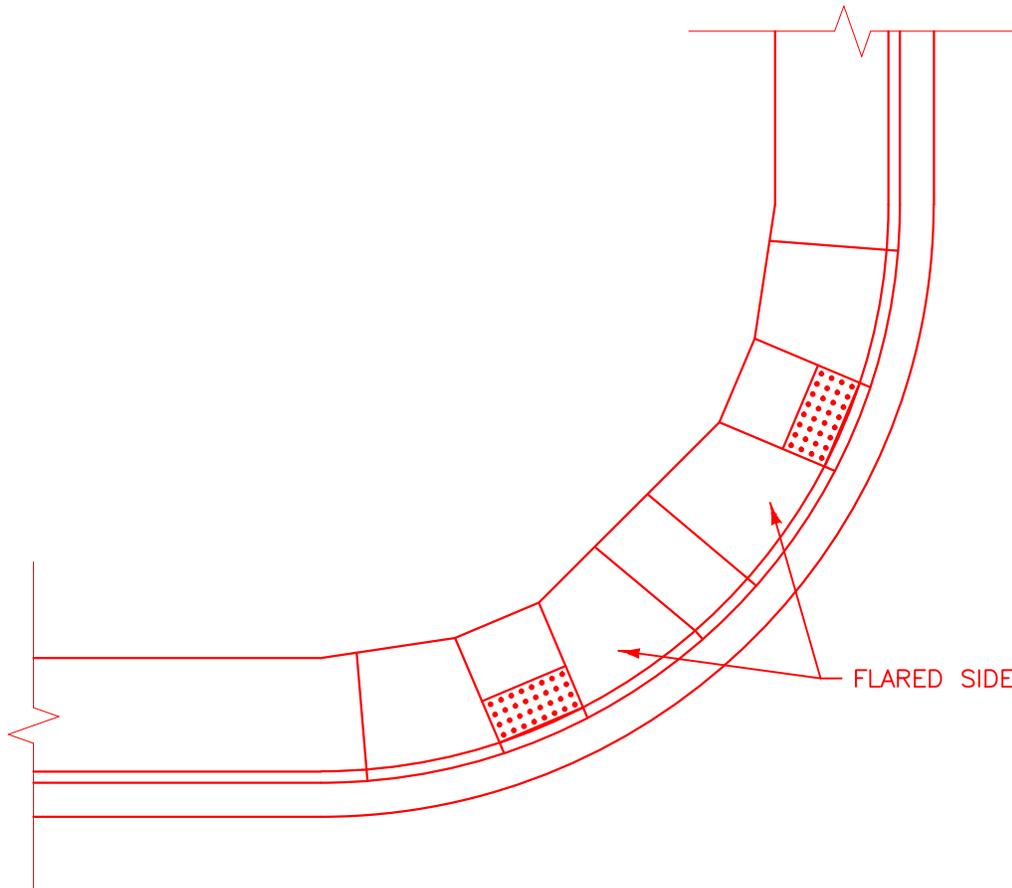
1. INSTALL TRUNCATED DOMES ON RAMP AS SPECIFIED.
2. SEE CURB SECTION FOR LAYDOWN CONFIGURATION (NO "LIP" ALLOWED AT GUTTER LINE)
3. RAMP FACES SHALL NOT EXCEED 12:1 SLOPE
4. ALL SIDEWALK SURFACES TO BE COARSE BROOMED TRAVERSE TO THE SLOPE OF THE RAMP.
5. INSTALL RAMP WITH A UNIFORM GRADE FREE OF SAGS AND SHORT GRADE CHANGES.
6. MAINTAIN NORMAL GUTTER LINE PROFILES THROUGH THE LAY DOWN AREA
7. INSTALL 4000 PSI CONCRETE (M-4000 PER MPWSS).

Malmstrom AFB
 Standard Drawings

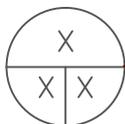
HANDICAP RAMP



SIDE VIEW



DIAGONAL PERPENDICULAR PUBLIC SIDEWALK CURB RAMP

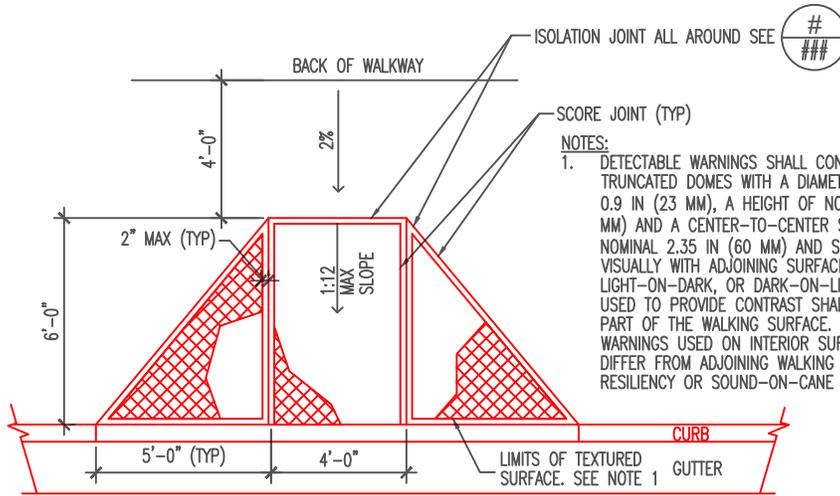


TRUNCATED DOME

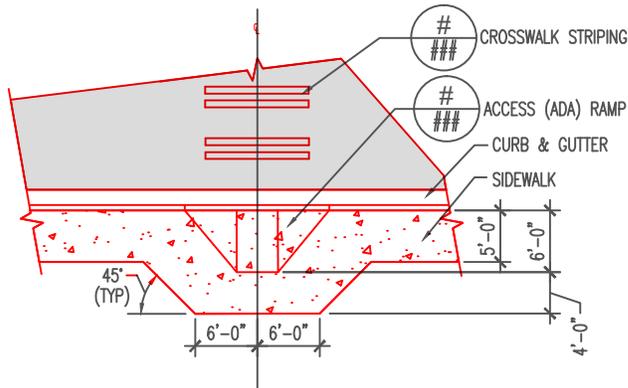
NO SCALE

NOTES:

1. RAMP TEXTURE IS TO BE DONE WITH AN EXPANDED METAL GRATE PLACED AND REMOVED FROM WET CONCRETE TO LEAVE A DIAMOND PATTERN. THE LONG AXIS OF THE DIAMOND SHALL BE PERPENDICULAR TO CURB. GROOVES SHALL BE 1/8" DEEP AND 1/4" WIDE.



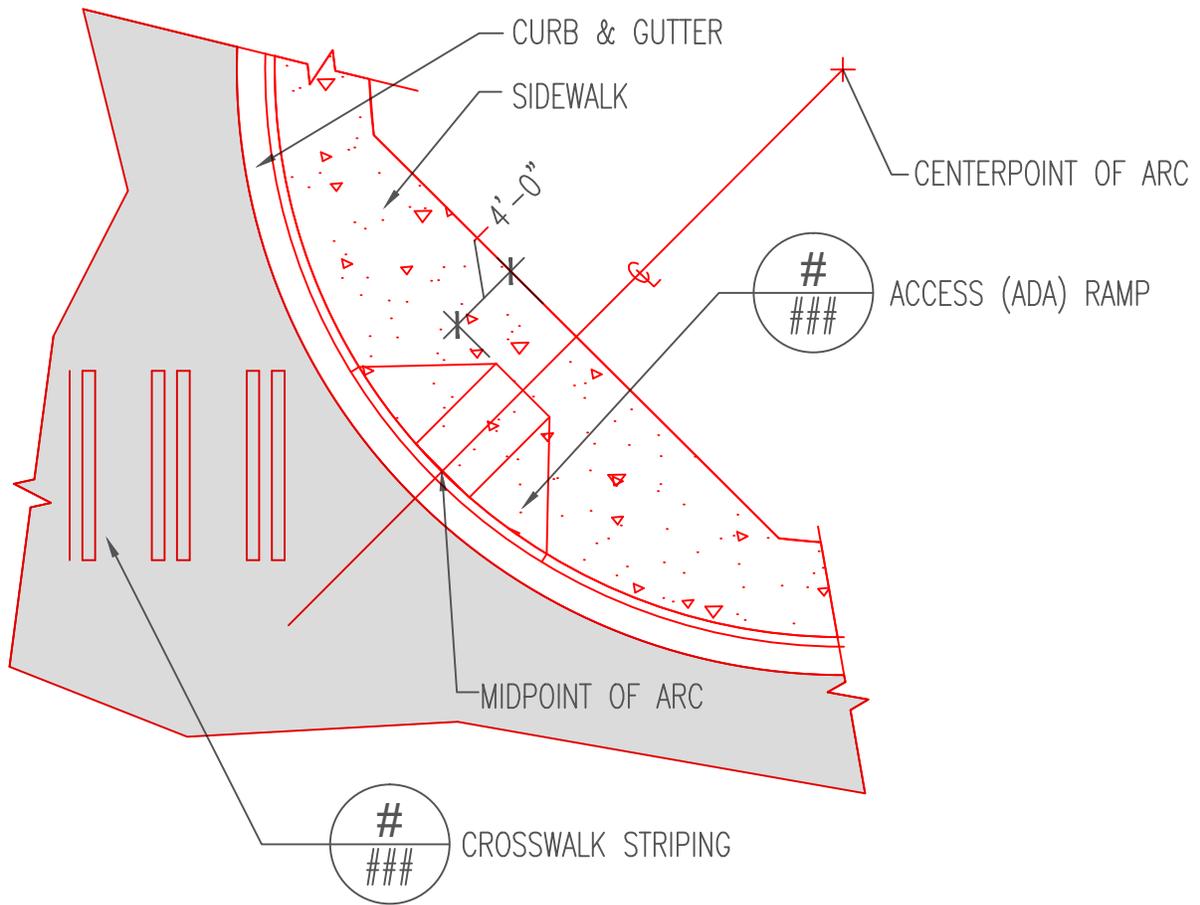
ACCESSIBLE SIDEWALK RAMP



TYPICAL IN-LINE RAMP & SIDEWALK

Malmstrom AFB
Standard Drawings

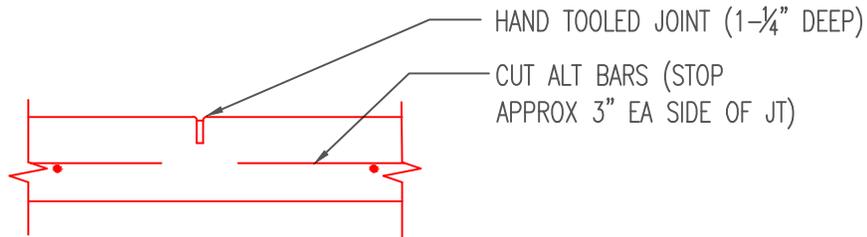
SIDEWALK RAMP



TYPICAL RAMP & SIDEWALK AT INTERSECTION

Malmstrom AFB
Standard Drawings

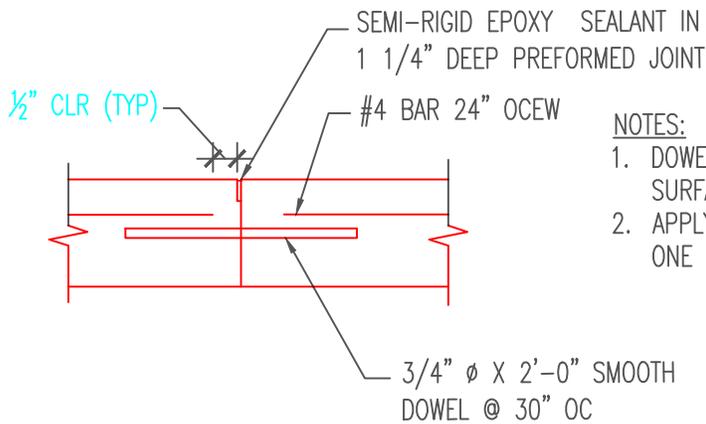
INTERSECTION SIDEWALK



NOTES:

1. FILL JT W/ SEMI-RIGID EPOXY SEALANT.
2. EDGE EACH SIDE OF JT WITH 1/4" RADIUS.

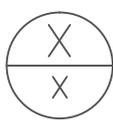
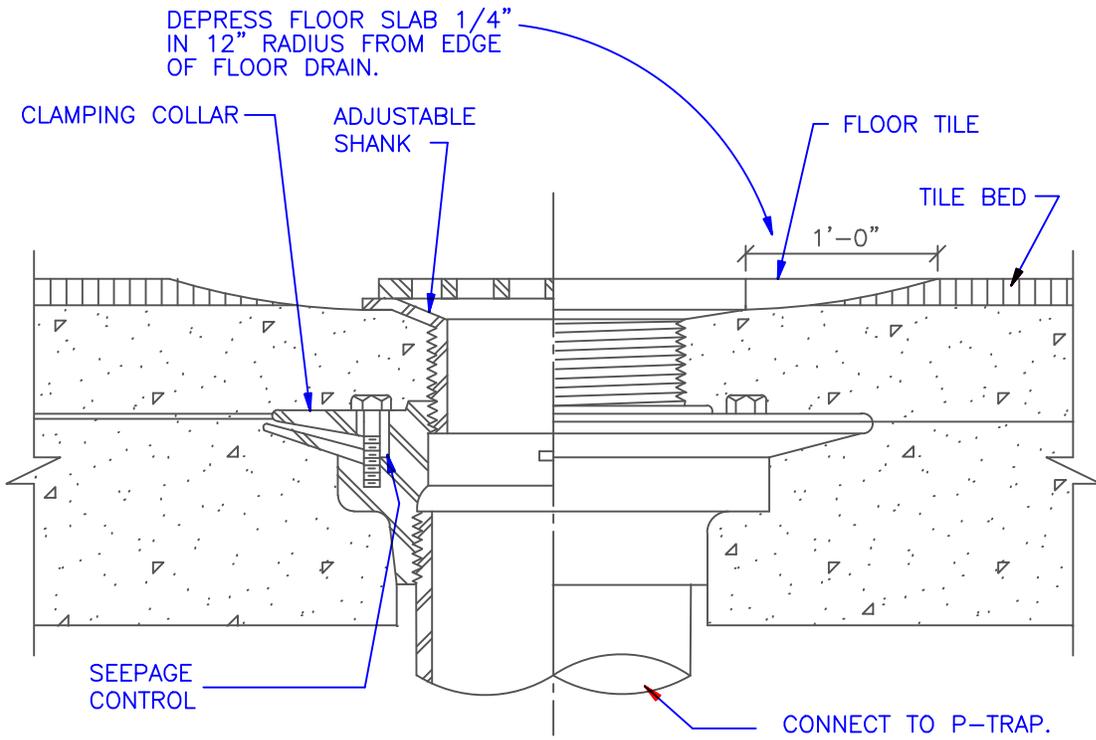
SHRINKAGE CONTROL JOINT (SJ)



NOTES:

1. DOWEL SHALL BE PARALLEL TO SLAB SURFACE AND PERP TO JT.
2. APPLY BOND BREAKER TO DOWEL ON ONE SIDE OF JT ONLY.

CONSTRUCTION JOINT (CJ)

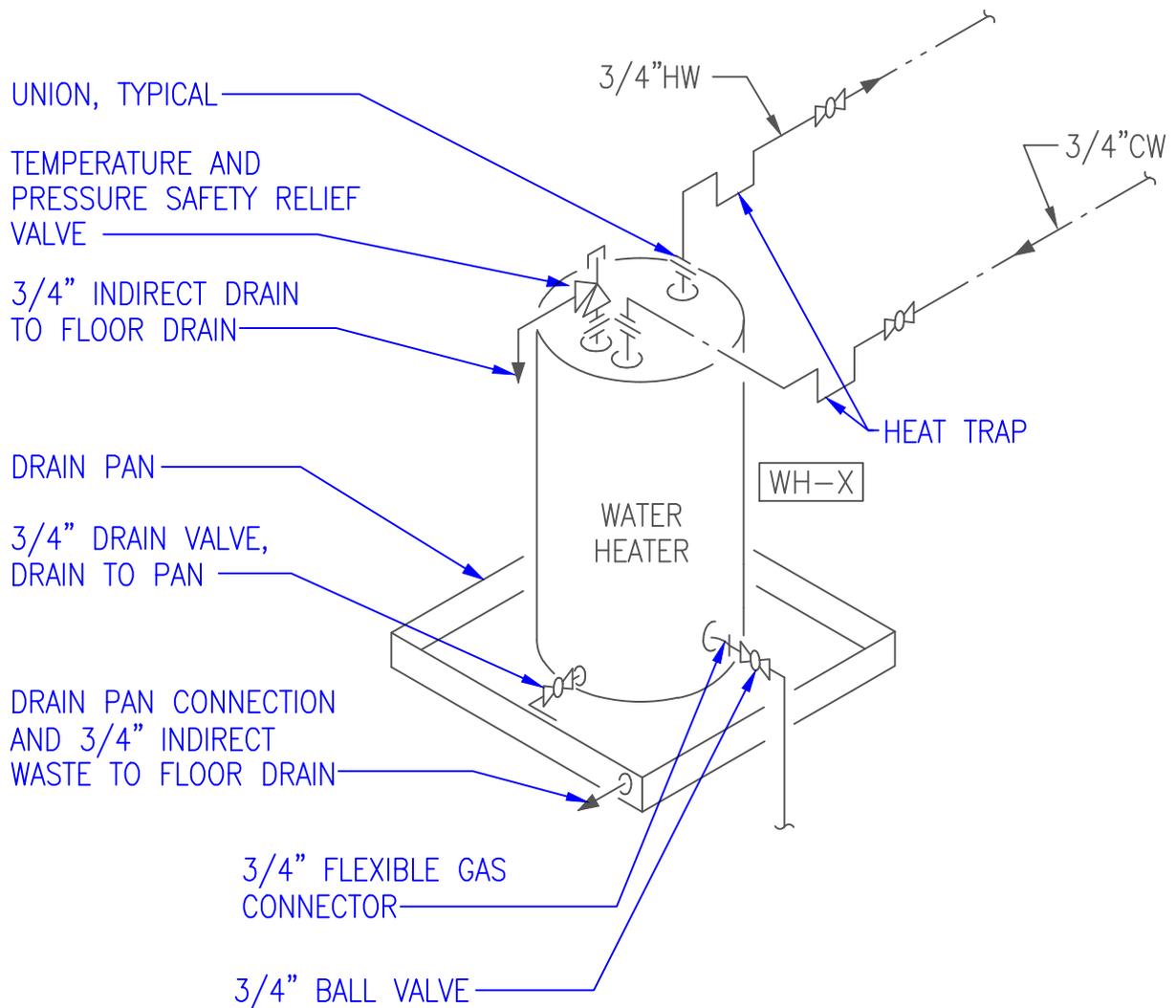


FLOOR DRAIN DETAIL

NOT TO SCALE

Malmstrom AFB
Standard Drawings

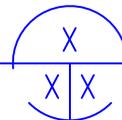
FLOOR DRAIN DETAIL



NOTE: FASTEN OR ANCHOR WATER HEATER TO FLOOR AND/OR WALLS TO CONTROL SEISMIC FORCES IN AN APPROVED MANNER. ANY ANCHORS/FASTENERS EXTENDING THROUGH DRAIN PAN SHALL BE SEALED WATER TIGHT.

WATER HEATER PIPING DIAGRAM

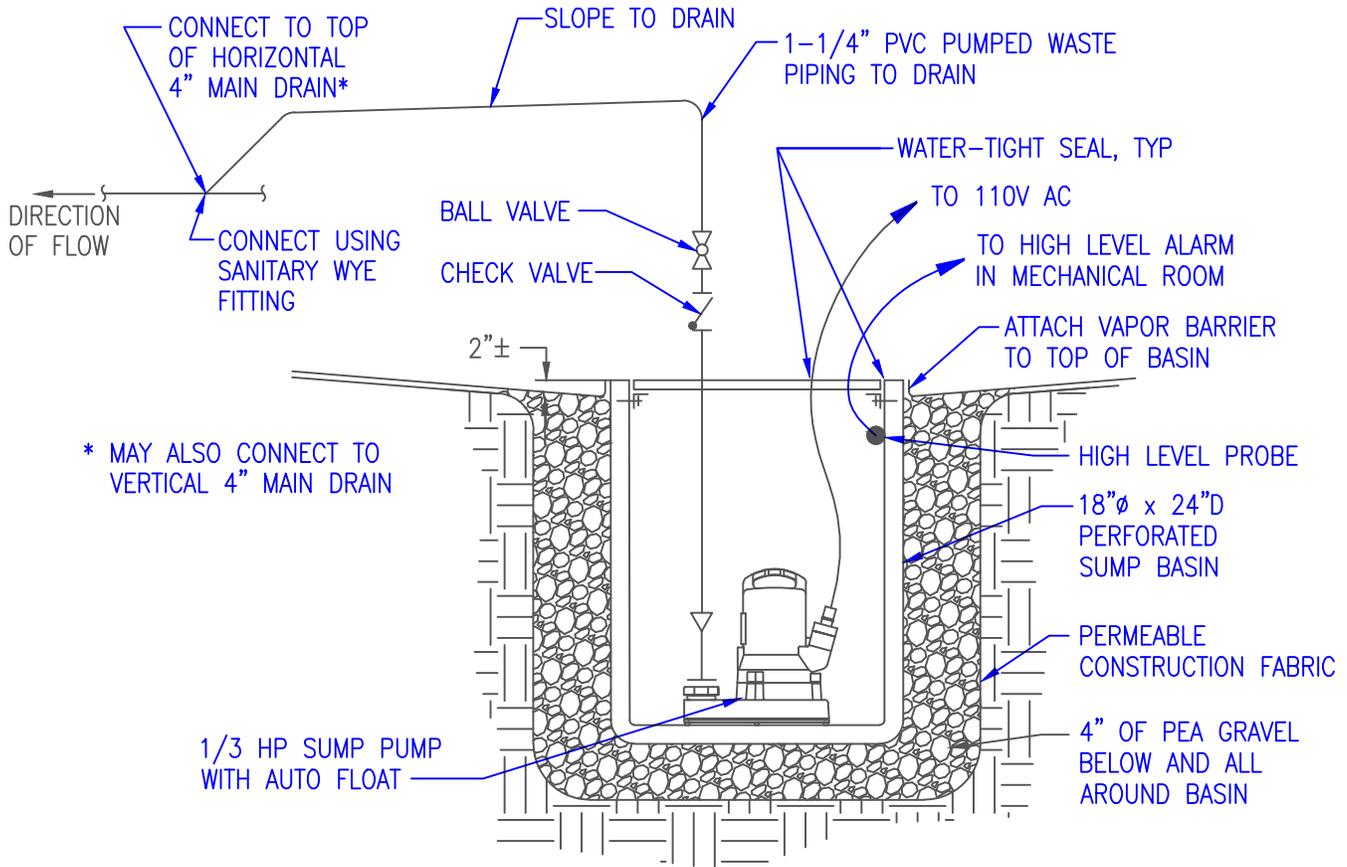
SCALE: NONE



Malmstrom AFB
Standard Drawings

WATER HEATER

NOTE: LOCATE SUMP PUMP BASIN AT LOW POINT IN CRAWLSPACE.



SUMP PUMP DRAIN CONNECTION AND SUMP BASIN DETAILS

SCALE: NONE



Malmstrom AFB
Standard Drawings

SUMP PUMP

1-1/2" PUMPED WASTE
EXTEND TO BLDG. EXTERIOR
AND CONNECT OT SANITARY
SEWER

WELDED BAR GRATING
19-W-4

1-1/2"x1-1/2"x3/16"
ANGLE TYPE 316L SS

CAST IRON SUBMERSIBLE
PUMP ZOELLER MODEL M53
OR EQUAL, 115/1, 0.3 HP
43 GPM @ 5FT OF HEAD
AUTOMATIC FLOAT OPERATION

CORD AND PLUG
ELECTRICAL CONNECTION

CUT GRATING TO ALLOW
PIPE PENETRATION

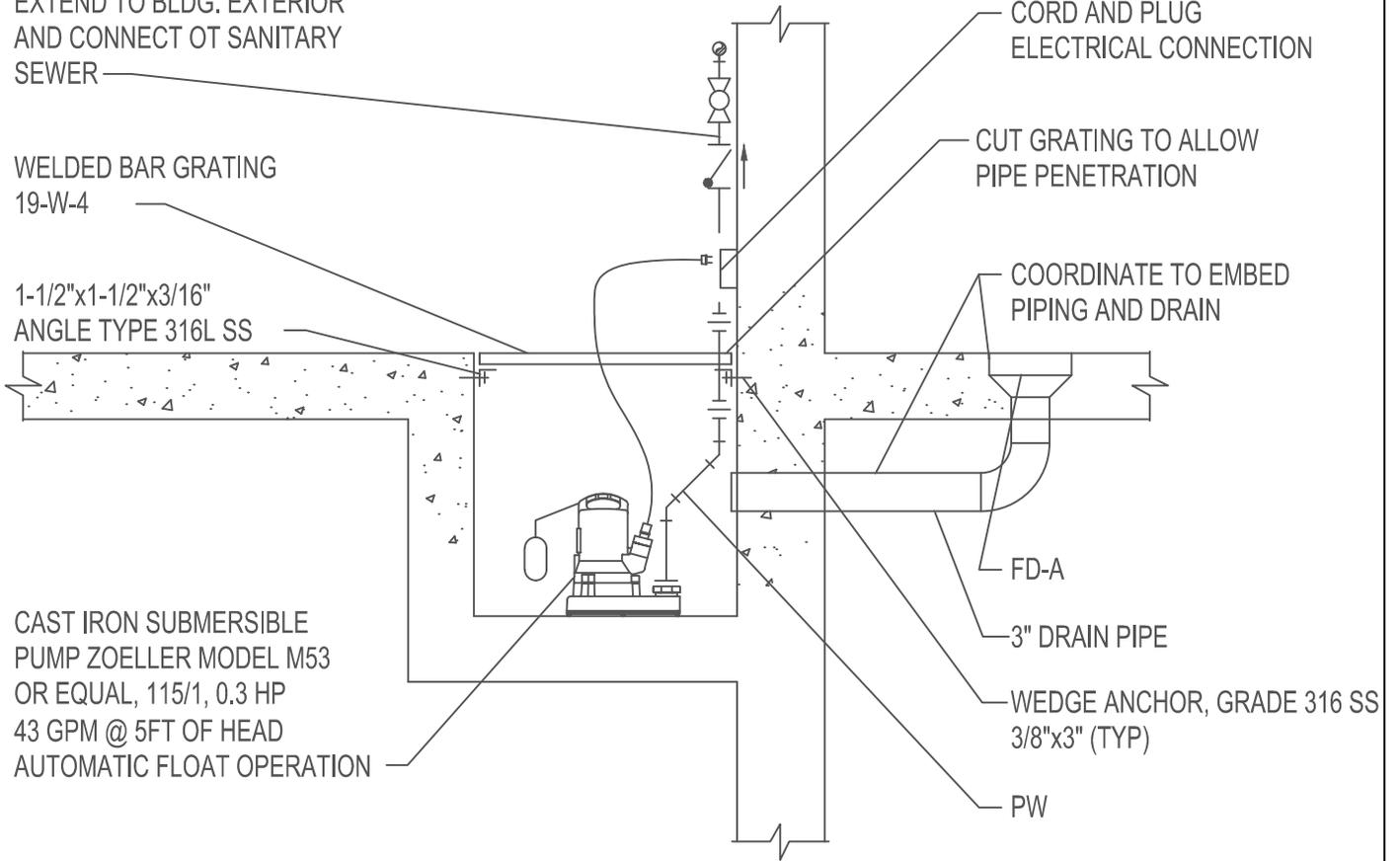
COORDINATE TO EMBED
PIPING AND DRAIN

FD-A

3" DRAIN PIPE

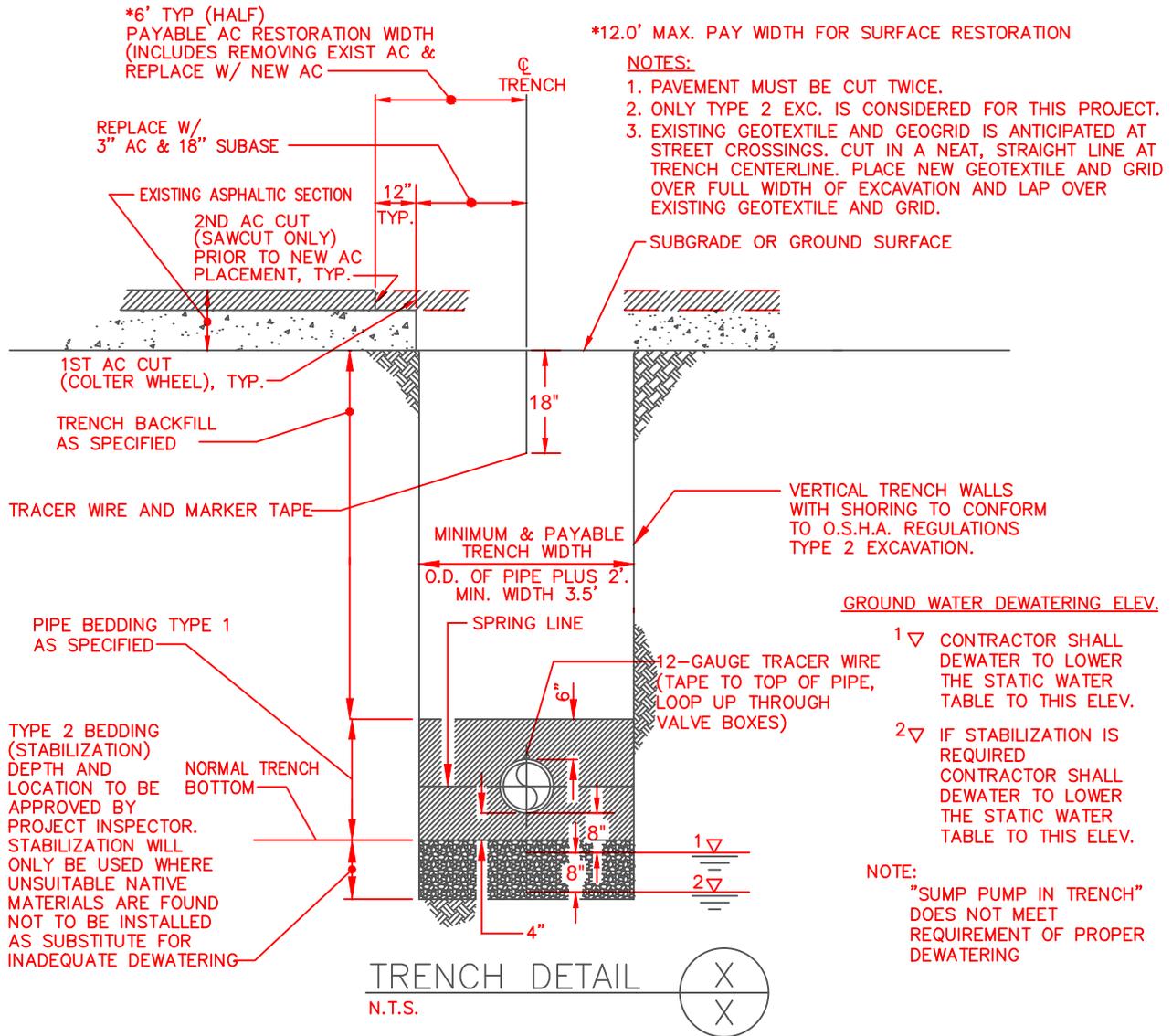
WEDGE ANCHOR, GRADE 316 SS
3/8"x3" (TYP)

PW



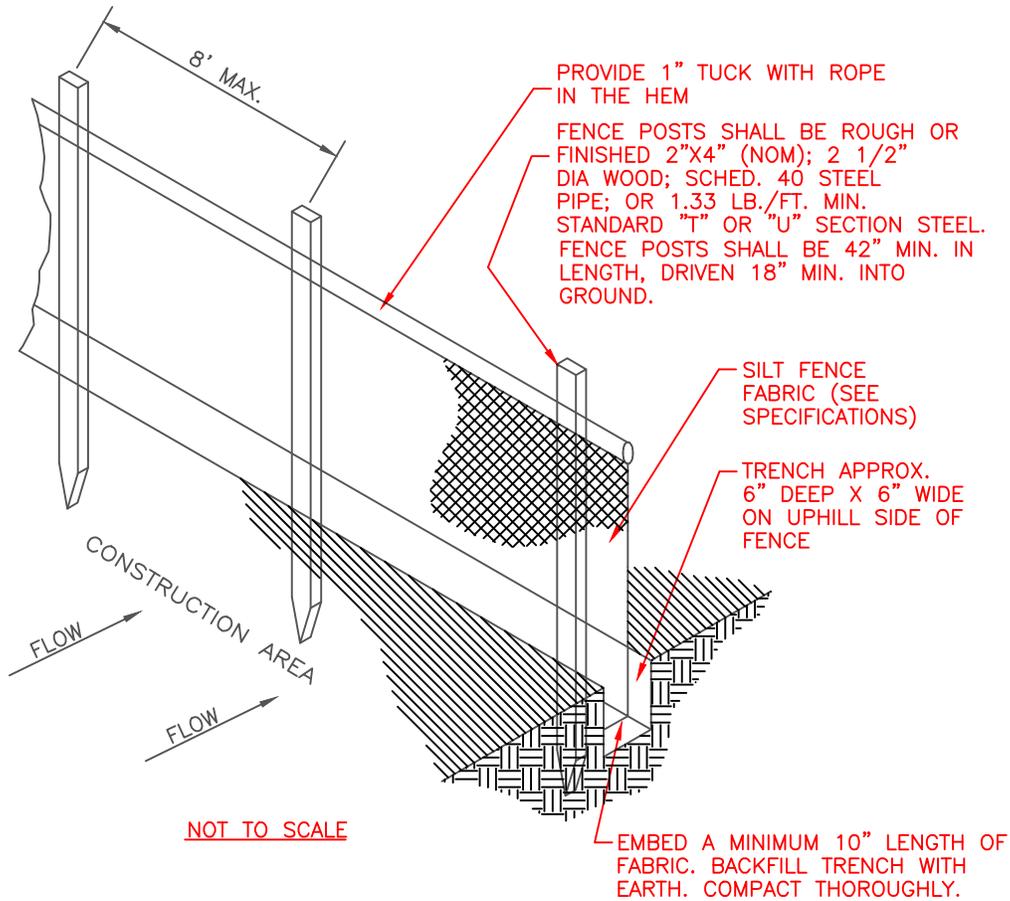
Malmstrom AFB
Standard Drawings

SUMP PUMP 2



Malmstrom AFB
Standard Drawings

UTILITY TRENCH
DETAIL



NOTES

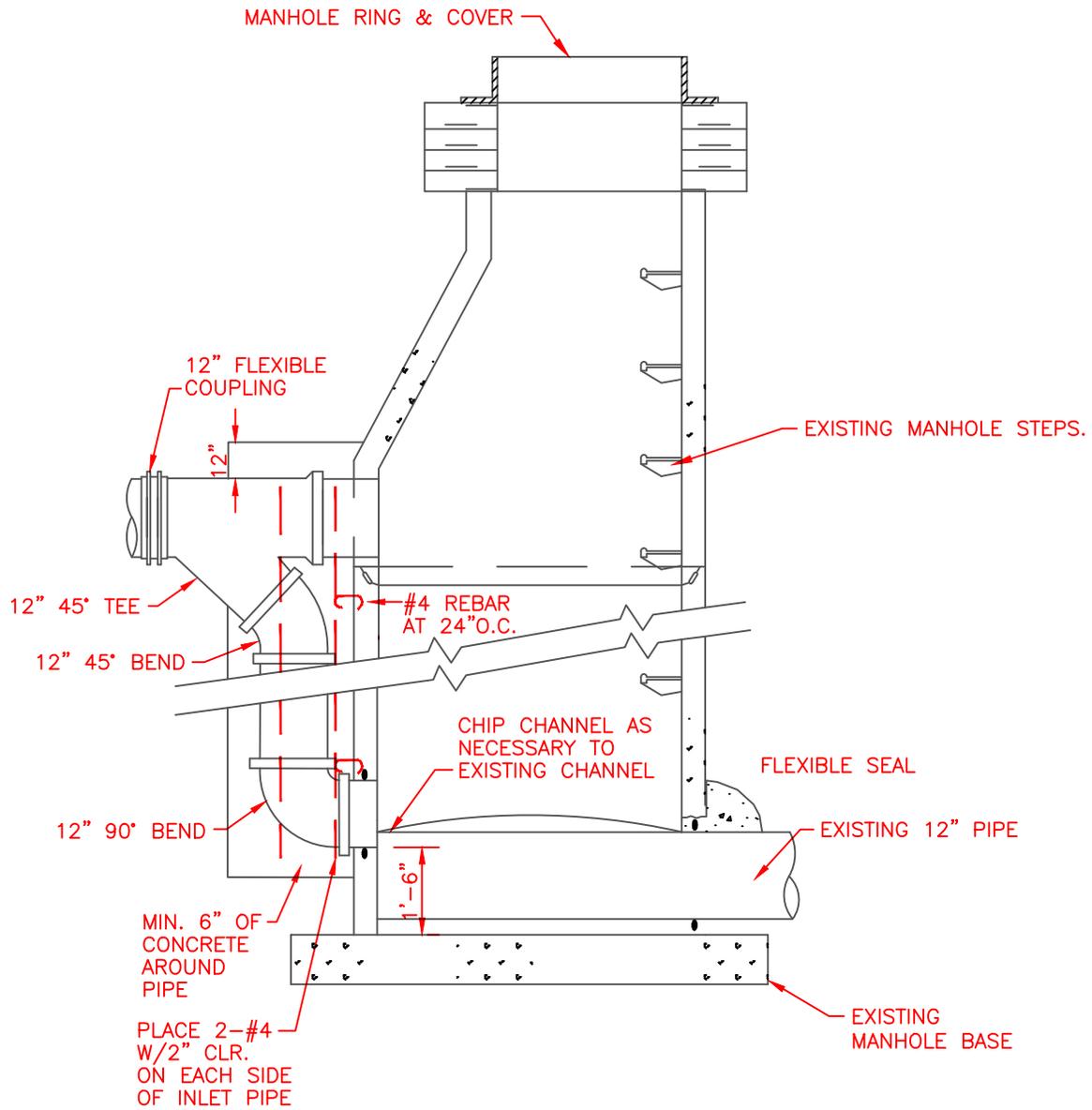
1. SILT FENCE FABRIC TO BE FASTENED SECURELY TO STEEL FENCE POST BY USE OF WIRE TIES OR HOG RINGS. (3 FASTENERS PER POST), FOR WOODEN POSTS, FASTENERS SHALL BE NO. 17 GAGE STAPLES (3/4" WIDE X 1/2" LONG), SPACED EVENLY AT 5 PER POST OR NO. 14 GAGE NAILS (1" LONG WITH 3/4" BUTTON HEAD) SPACED EVENLY AT 4 PER POST.
2. ENDS OF INDIVIDUAL ROLLS OF FABRIC SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST WITH A MINIMUM 6" OVERLAP.

DETAIL 

NO SCALE

Malmstrom AFB
Standard Drawings

SILT FENCE DETAIL



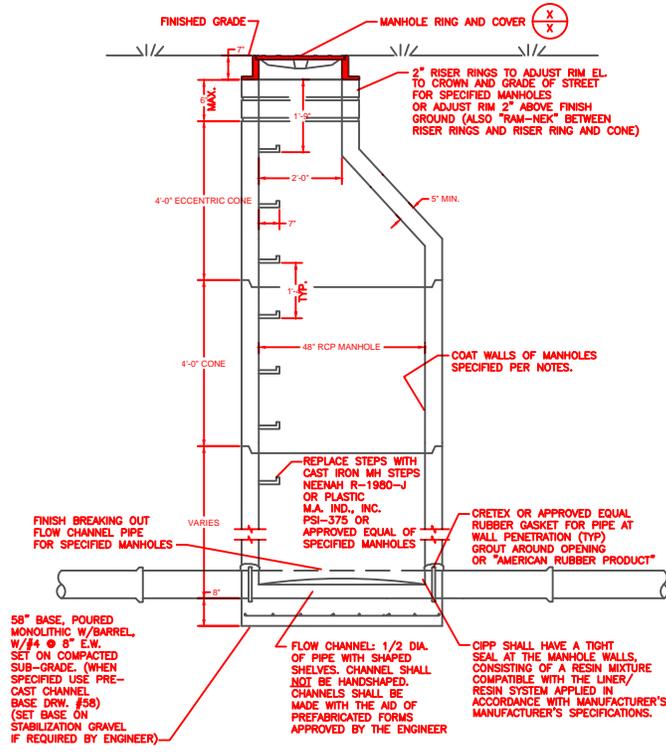
DROP MANHOLE DETAIL

NO SCALE

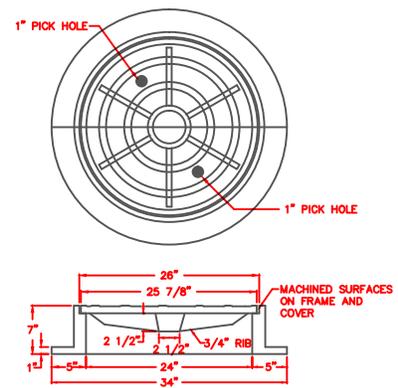


Malmstrom AFB
Standard Drawings

DROP MANHOLE DETAIL



TYPICAL MANHOLE SECTION (X)
N.T.S. (X)



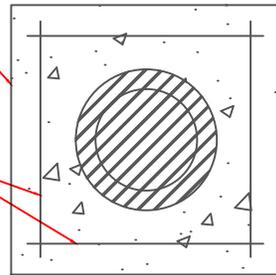
TYPICAL MANHOLE RING & COVER (X)
N.T.S. (X)

Malmstrom AFB
Standard Drawings

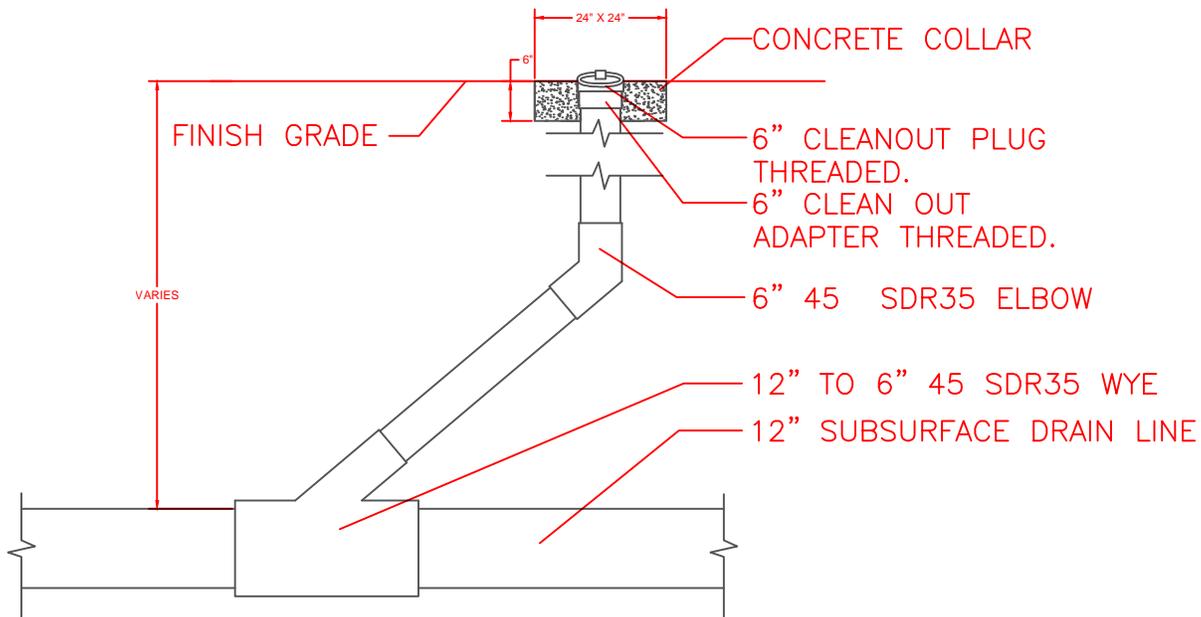
MANHOLE DETAIL

CONCRETE

#4, BOTH
WAYS



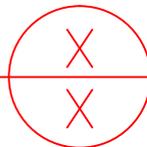
PLAN VIEW



PROVIDE 1 CLEAN OUT EVERY 100 FEET, OR AS SHOWN ON DRAWING, WITH ONE AT THE TOP END OF THE LINE.

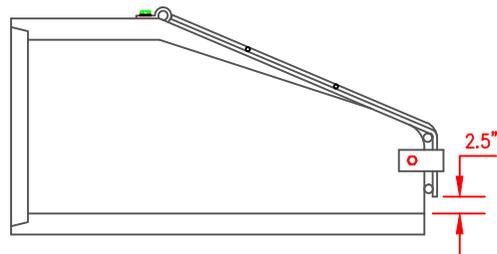
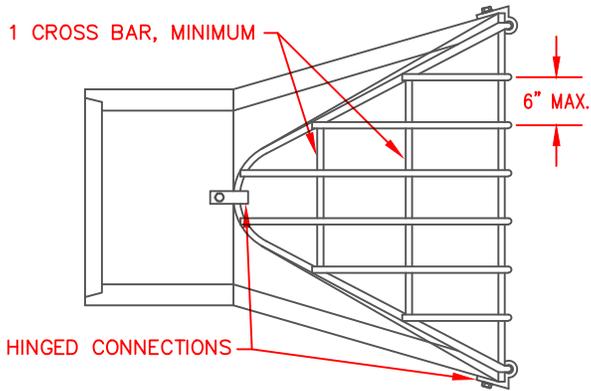
SOLID WALL CLEANOUT

NO SCALE

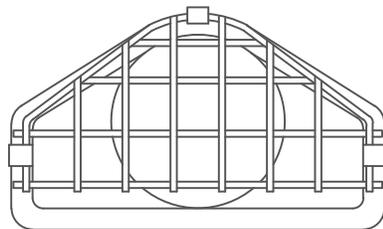


Malmstrom AFB
Standard Drawings

CLEANOUT DETAIL



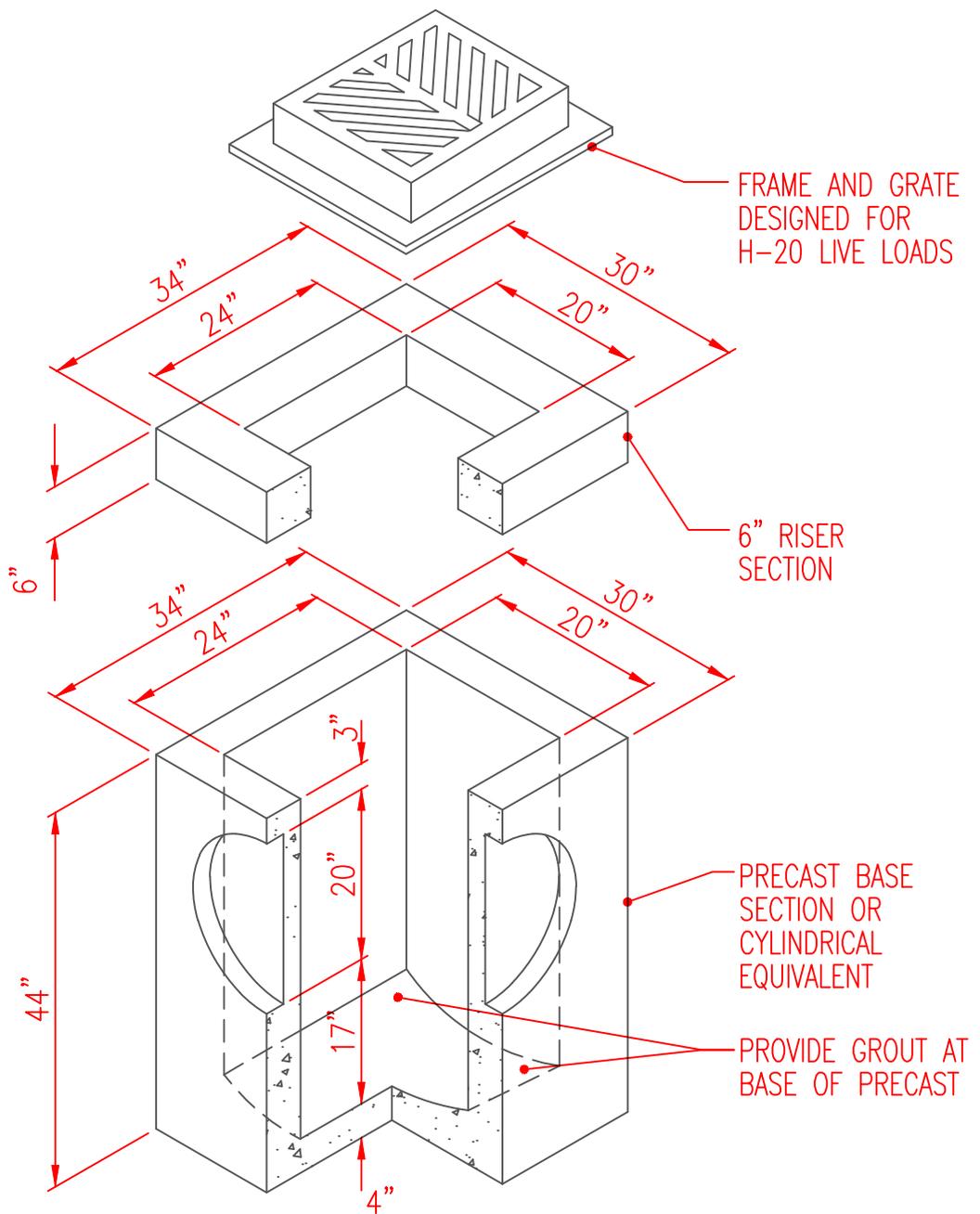
NOTE:
HOT DIP GALVANIZED, PER ASTM A153.



TRASH RACK DETAIL (X)
N.T.S. (X)

Malmstrom AFB
Standard Drawings

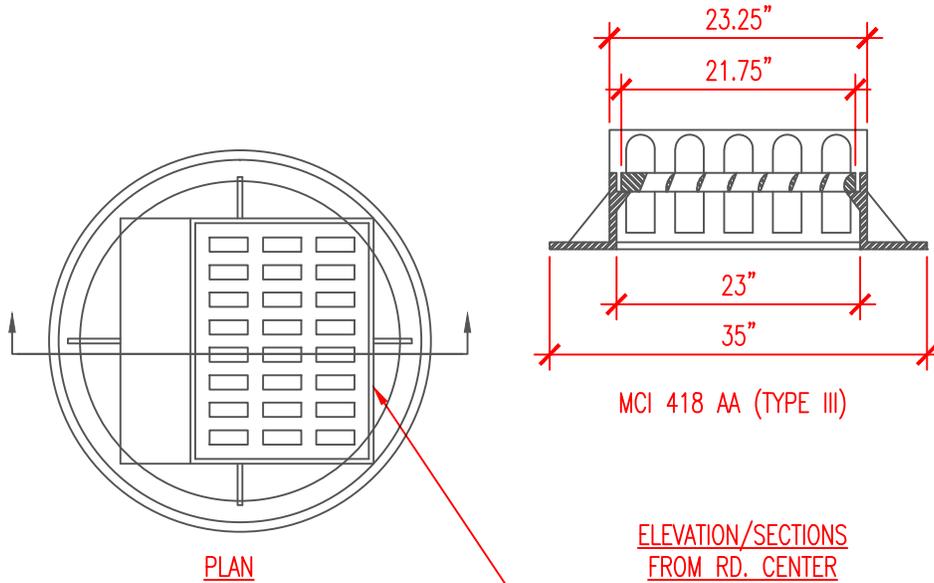
STORMWATER
TRASH GRATE



NOTE:
A 5" THICK CYLINDRICAL STRUCTURE OF EQUIVALENT CROSS-SECTIONAL AREA MAY BE USED AS AN ALTERNATIVE IF DESIRED.

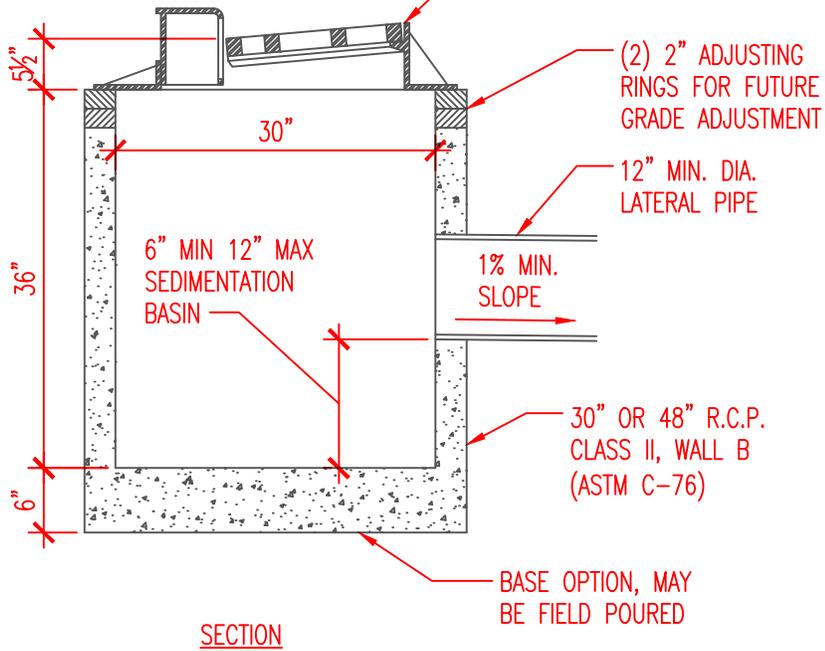
Malmstrom AFB
Standard Drawings

CATCH BASIN



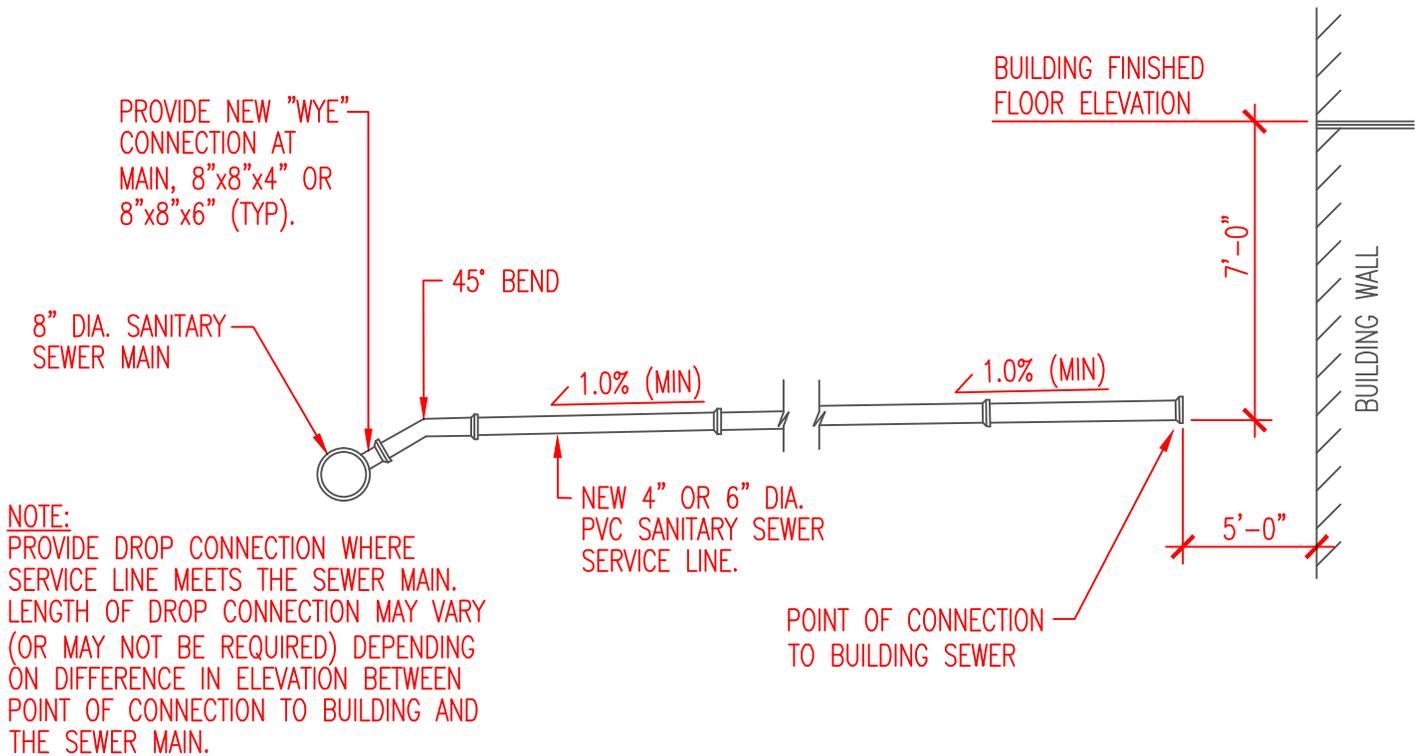
MCI 418 AA (TYPE III)

MCI-418A OR 418 AA OR APPROVED EQUAL



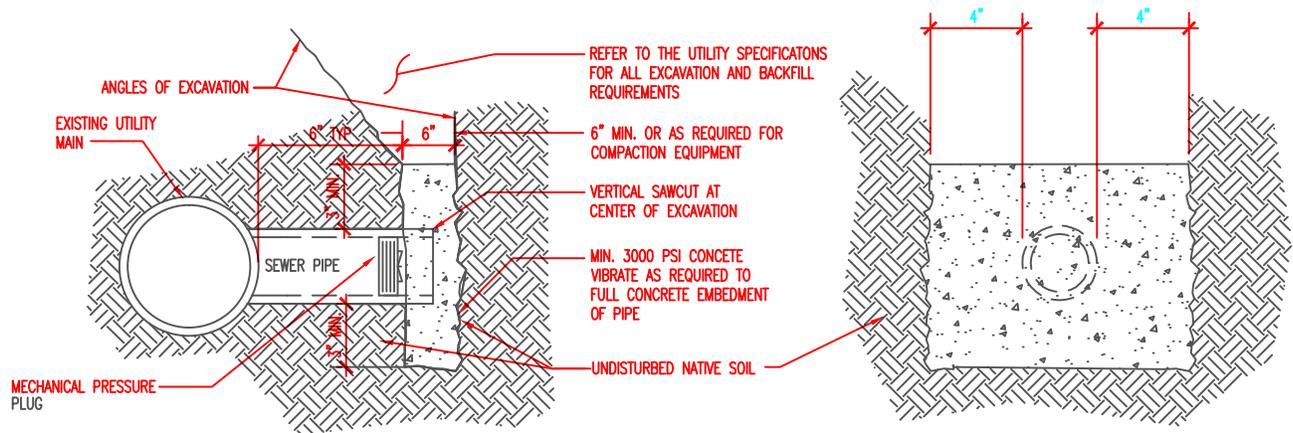
Malmstrom AFB
Standard Drawings

CURB INLET

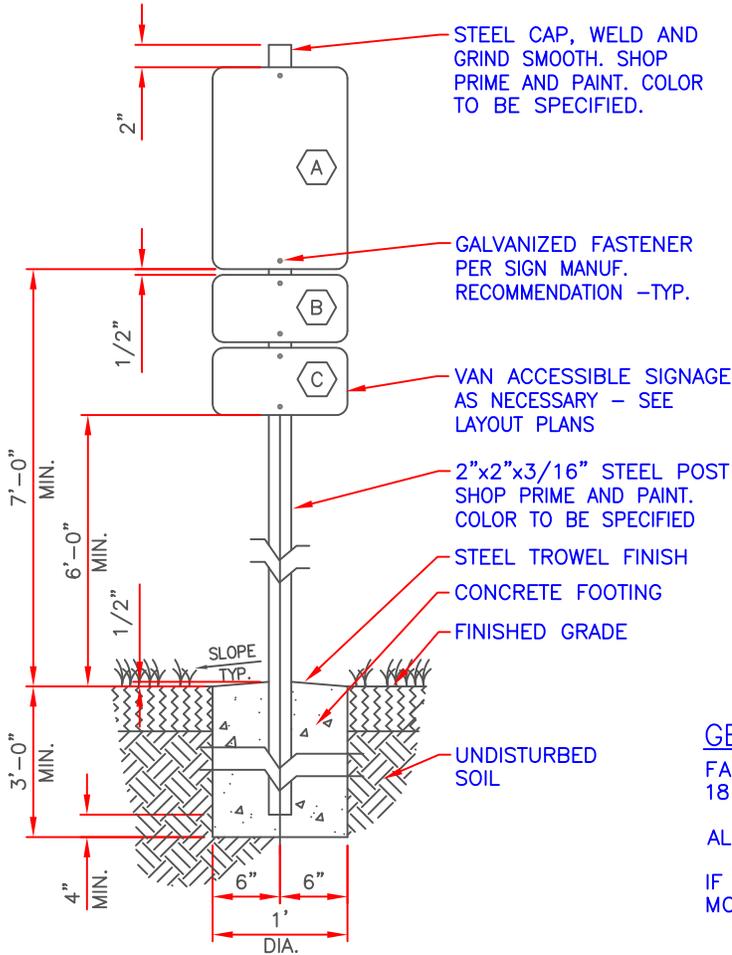


Malmstrom AFB
 Standard Drawings

BUILDING CONNECTION



NOTE: THIS DETAIL WILL TYPICALLY APPLY TO PIPE MATERIALS SUCH AS IRON, SOIL, OR CONCRETE PIPE. IF AVAILABLE, PIPE MANUFACTURER STANDARD END CAP FITTINGS MAY BE USED IN REPLACEMENT OF THE DETAIL ABOVE. FOLLOW PIPE MANUFACTURER RECOMMENDATIONS FOR INSTALLATION TO ENSURE WATERTIGHT CONDITION.



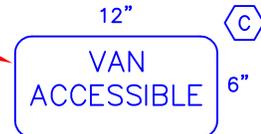
RESERVED PARKING SIGN, MANUF: BEST SIGN SYSTEMS (800) 235-2378, MODEL: SS06 FLAT SCREENED STEEL OR APPROVED EQUAL



PERMIT SIGN MODEL: SS63



VAN SIGN MODEL: SS52



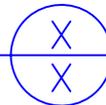
GENERAL NOTES:

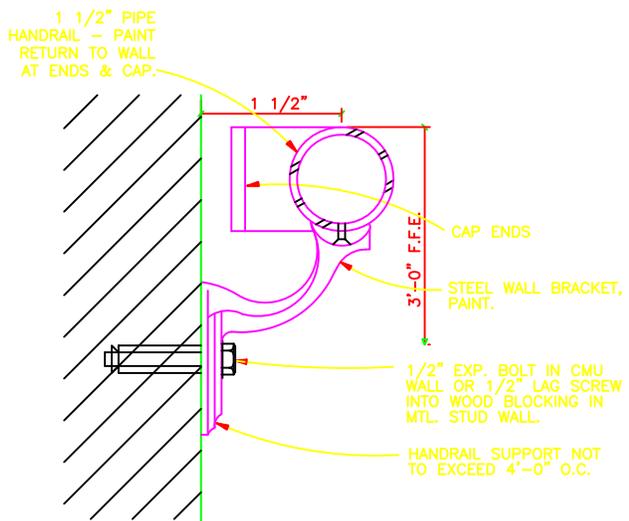
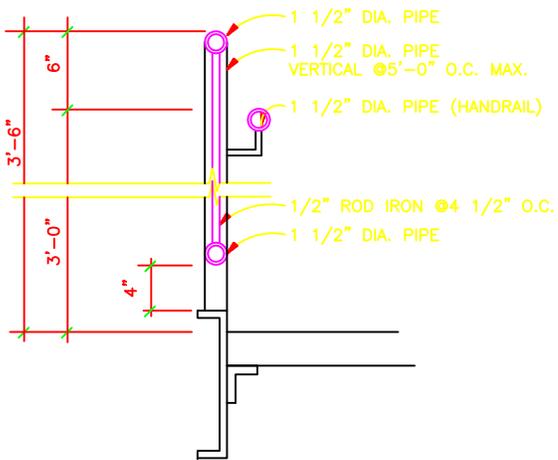
FABRICATE SIGN PANELS OF 18 GA. STEEL OR .063 ALUMINUM

ALL FASTENERS TO BE GALVANIZED

IF SUPPLEMENTARY SIGNS ARE USED MOUNTING HEIGHT IS 6'-0" MINIMUM

HANDICAP SIGNAGE
N.T.S.





GUARDRAIL DETAIL

POWDER COAT ALL RAILING SYSTEMS

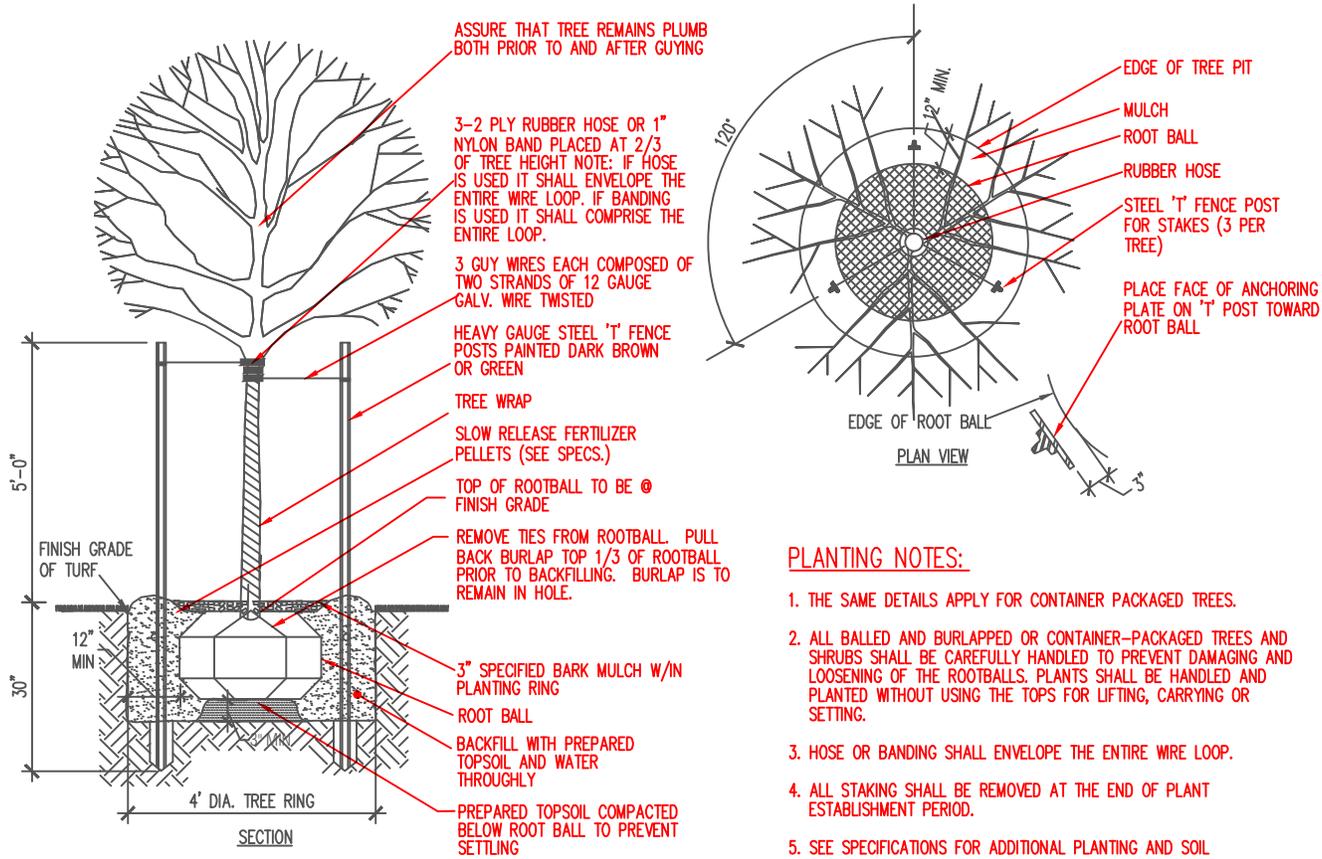
N.T.S.



HANDRAIL MOUNTING DETAIL

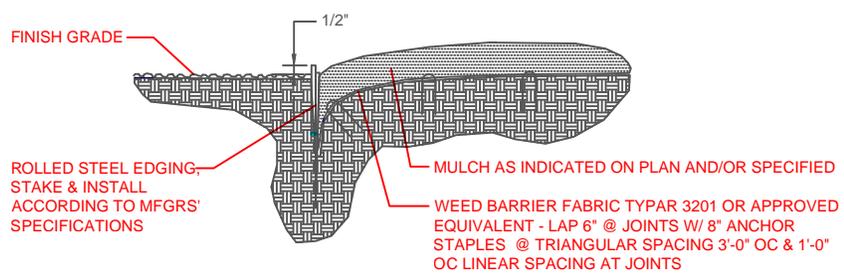
POWDER COAT ALL RAILING SYSTEMS

N.T.S.



PLANTING NOTES:

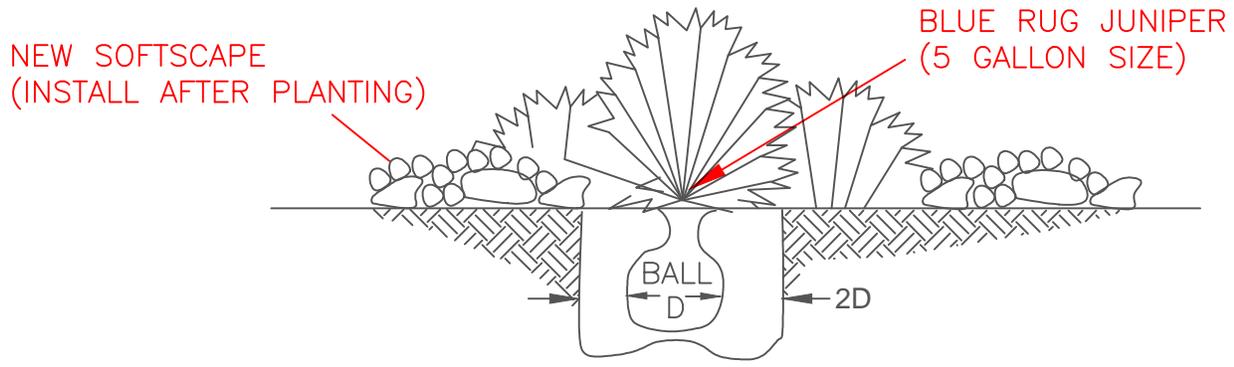
1. THE SAME DETAILS APPLY FOR CONTAINER PACKAGED TREES.
2. ALL BALLED AND BURLAPPED OR CONTAINER-PACKAGED TREES AND SHRUBS SHALL BE CAREFULLY HANDLED TO PREVENT DAMAGING AND LOOSENING OF THE ROOTBALLS. PLANTS SHALL BE HANDLED AND PLANTED WITHOUT USING THE TOPS FOR LIFTING, CARRYING OR SETTING.
3. HOSE OR BANDING SHALL ENVELOPE THE ENTIRE WIRE LOOP.
4. ALL STAKING SHALL BE REMOVED AT THE END OF PLANT ESTABLISHMENT PERIOD.
5. SEE SPECIFICATIONS FOR ADDITIONAL PLANTING AND SOIL PREPARATION INFORMATION.



 **STEEL EDGING DETAIL**
NO SCALE

Malmstrom AFB
Standard Drawings

Deciduous Trees
Planting Detail



PLANTING NOTES:

1. LOOSEN SOIL IN THE BOTTOM OF THE PLANTING HOLE.
2. SCORE SIDES OF THE HOLE.



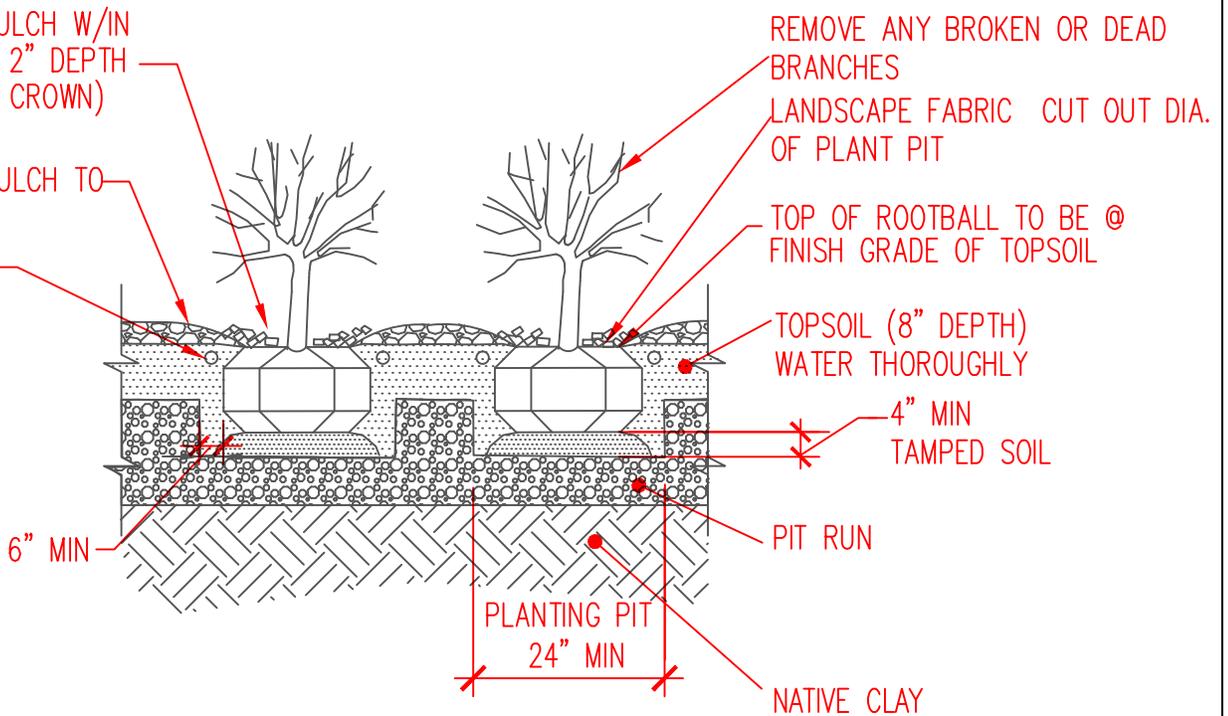
NOTE:

ARRANGEMENT AND SPACING OF PLANTS AND
SHAPE AND SIZE OF PLANTING BEDS VARY,
SEE PLANS.

SPECIFIED BARK MULCH W/IN
PLANTING RING TO 2" DEPTH
(PULL AWAY FROM CROWN)

SPECIFIED ROCK MULCH TO
4" DEPTH

SLOW RELEASE
FERTILIZER
PELLETS (SEE
SPECS.)

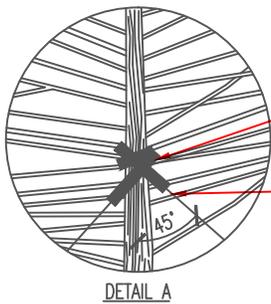


Malmstrom AFB
Standard Drawings

Shrub Planting Detail

PLANTING NOTES:

1. THE SAME DETAILS APPLY FOR CONTAINER PACKAGED TREES.
2. ALL BALLED AND BURLAPPED OR CONTAINER-PACKAGED TREES AND SHRUBS SHALL BE CAREFULLY HANDLED TO PREVENT DAMAGING AND LOOSENING OF THE ROOT BALLS. PLANTS SHALL BE HANDLED AND PLANTED WITHOUT USING THE TOPS FOR LIFTING, CARRYING OR SETTING.
3. HOSE OR BANDING SHALL ENVELOPE THE ENTIRE WIRE LOOP.
4. ALL STAKING SHALL BE REMOVED AT THE END OF PLANT ESTABLISHMENT PERIOD.
5. SEE SPECIFICATIONS FOR ADDITIONAL PLANTING AND SOIL PREPARATION INFORMATION.



1" NYLON BAND OR 3-2 PLY RUBBER HOSE PLACED AT 2/3 OF TREE HEIGHT

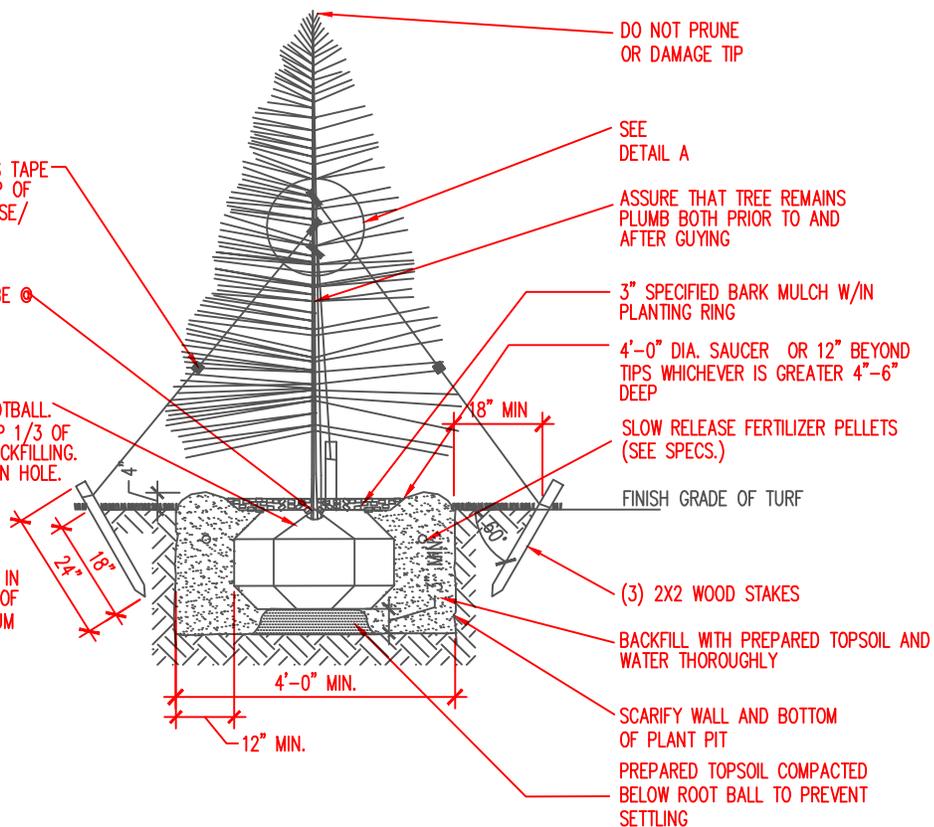
3 GUY WIRES EACH COMPOSED OF TWO STRANDS OF 12 GAUGE GALV. WIRE TWISTED

(3) 12" RED ENGINEER'S TAPE CENTERED BETWEEN TOP OF STAKE AND RUBBER HOSE/ NYLON BAND

TOP OF ROOTBALL TO BE @ FINISH GRADE

REMOVE TIES FROM ROOTBALL. PULL BACK BURLAP TOP 1/3 OF ROOTBALL PRIOR TO BACKFILLING. BURLAP IS TO REMAIN IN HOLE.

NOTE: OVERALL DEPTH VARIES IN PROPORTION WITH SIZE OF ROOT BALL/ 24" MINIMUM DEPTH



Malmstrom AFB
Standard Drawings

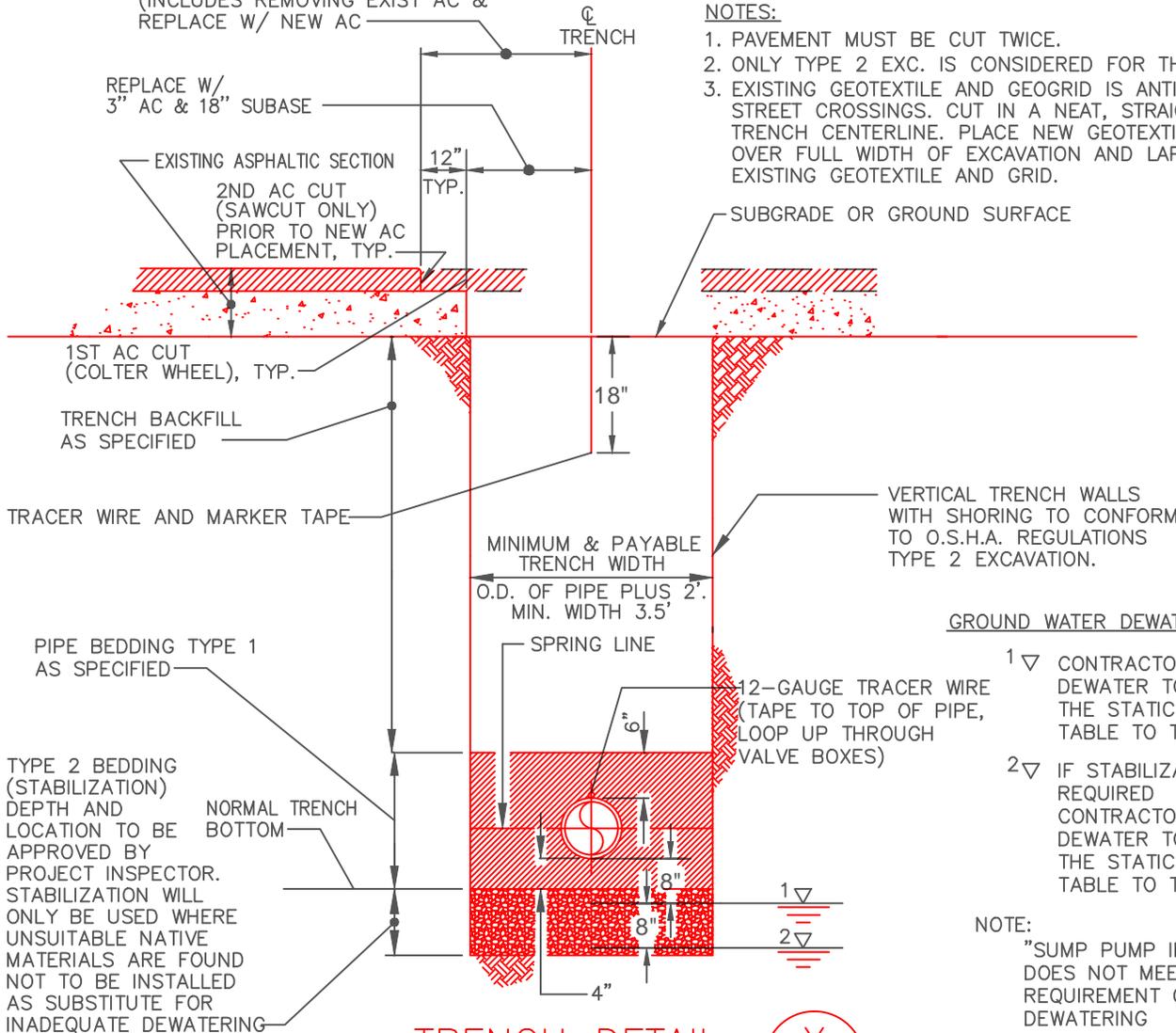
Conifer Planting Detail

*6' TYP (HALF)
PAYABLE AC RESTORATION WIDTH
(INCLUDES REMOVING EXIST AC &
REPLACE W/ NEW AC

*12.0' MAX. PAY WIDTH FOR SURFACE RESTORATION

NOTES:

1. PAVEMENT MUST BE CUT TWICE.
2. ONLY TYPE 2 EXC. IS CONSIDERED FOR THIS PROJECT.
3. EXISTING GEOTEXTILE AND GEOGRID IS ANTICIPATED AT STREET CROSSINGS. CUT IN A NEAT, STRAIGHT LINE AT TRENCH CENTERLINE. PLACE NEW GEOTEXTILE AND GRID OVER FULL WIDTH OF EXCAVATION AND LAP OVER EXISTING GEOTEXTILE AND GRID.



GROUND WATER DEWATERING ELEV.

- 1 ∇ CONTRACTOR SHALL DEWATER TO LOWER THE STATIC WATER TABLE TO THIS ELEV.
- 2 ∇ IF STABILIZATION IS REQUIRED CONTRACTOR SHALL DEWATER TO LOWER THE STATIC WATER TABLE TO THIS ELEV.

NOTE:

"SUMP PUMP IN TRENCH" DOES NOT MEET REQUIREMENT OF PROPER DEWATERING

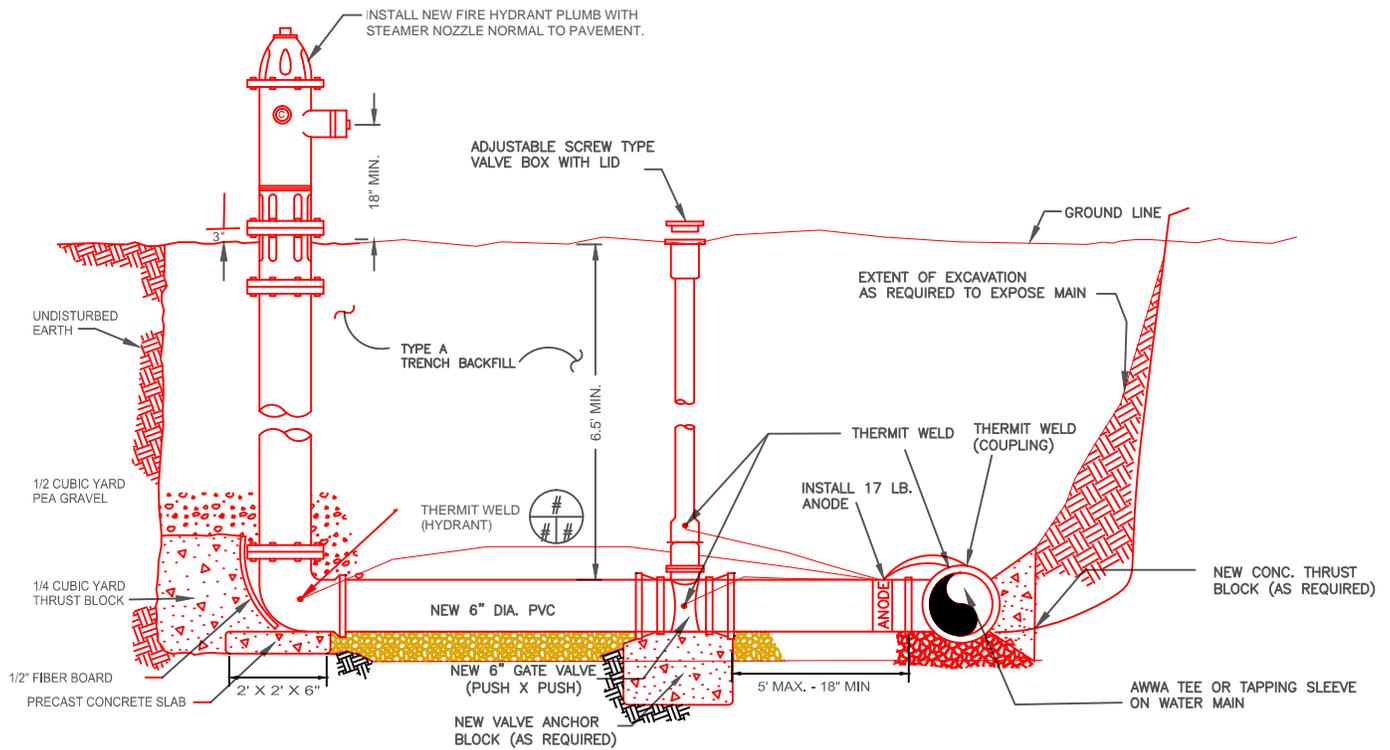
TRENCH DETAIL

N.T.S.



Malmstrom AFB
Standard Drawings

UTILITY TRENCH DETAIL



NOTES:

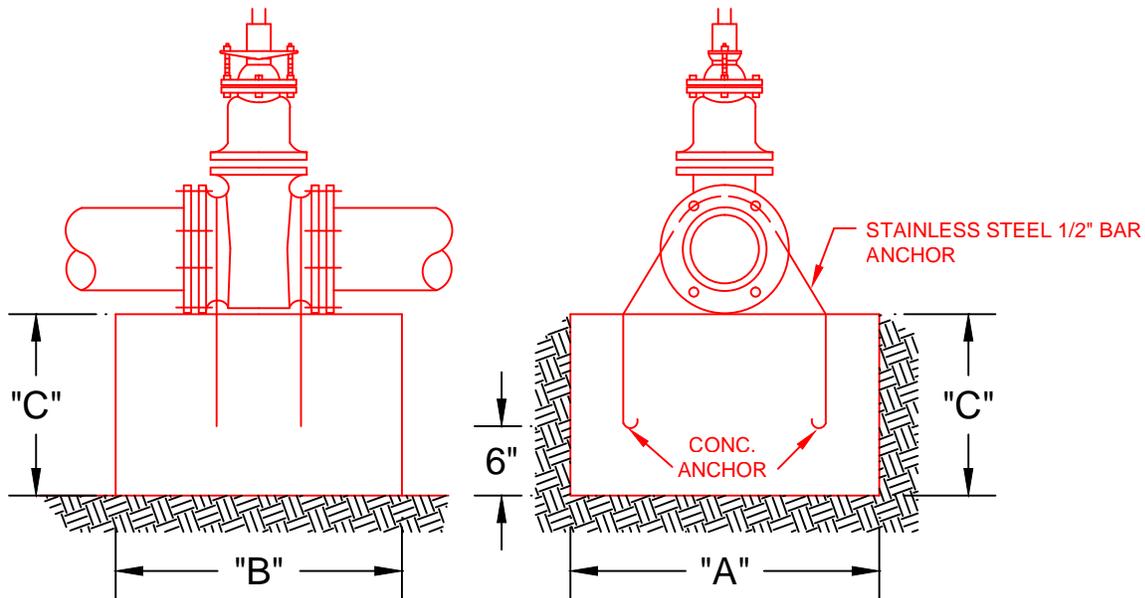
1. THRUST BLOCKING TO BE IN CONFORMANCE WITH MPWSS
2. FOR BOLTED FITTINGS, BLOCKING SHALL NOT OBSTRUCT BOLTS.
3. HYDRANT WEEP HOLES TO REMAIN UNOBSTRUCTED.
4. FIRE HYDRANT TO BE PAINTED DARK BROWN FEDERAL COLOR # 37056
5. BONNET TO BE PAINTED BASED ON FLOW RANGE
 - CLASS AA - LIGHT BLUE > 1500 GPM
 - CLASS A - GREEN 1000-1500 GPM
 - CLASS B - ORANGE 500-999 GPM
 - CLASS C - RED < 500 GPM



NEW FIRE HYDRANT
NO SCALE

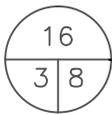
Malmstrom AFB
Standard Drawings

FIRE HYDRANT



THRUST BLOCK DIMENSIONS																
ANCHOR ROD SIZE	VALVE SIZE	100 PSI			150 PSI			200 PSI			250 PSI			300 PSI		
		"A"	"B"	"C"												
3/4"	6" & 8"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-7"

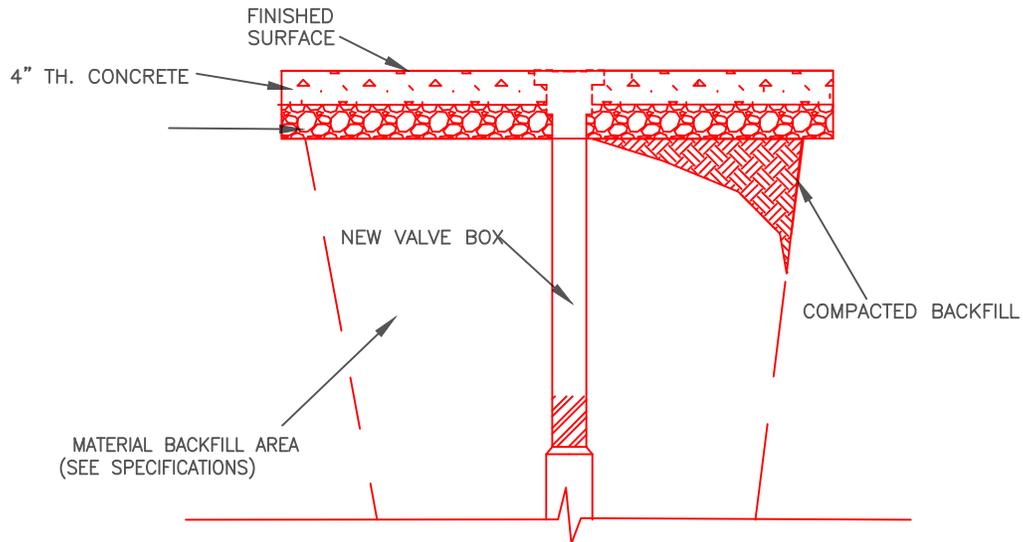
NOTE: PRESSURES SHOWN ABOVE ARE MAXIMUM WORKING PRESSURE IN SYSTEM.



THRUST BLOCKING FOR WATER MAIN VALVES
NO SCALE

Malmstrom AFB
Standard Drawings

VALVE THRUST BLOCK



NOTES:

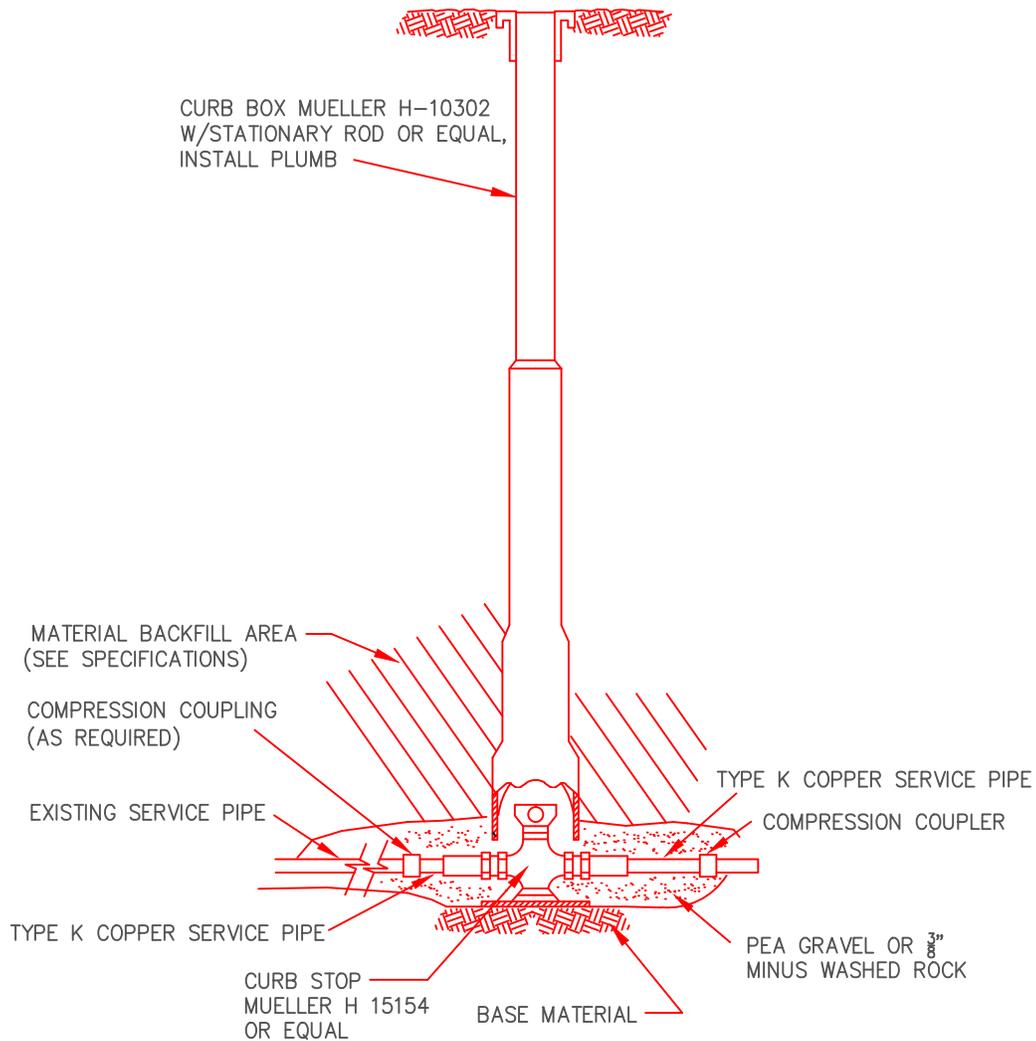
1. ADJUST VALVE BOX TO NEW PAVEMENT HEIGHT BY EXTENSION OR RETRACTION OF THE EXISTING HARDWARE OR THE ADDITION OF AN EXTENSION TOP AS NECESSARY.
2. EXCAVATE AND ALIGN THE VALVE BOX IF NECESSARY TO PROVIDE FREE KEY ACCESS.



WATER VALVE BOX ADJUSTMENT
NO SCALE

Malmstrom AFB
Standard Drawings

VALVE ADJUSTMENT

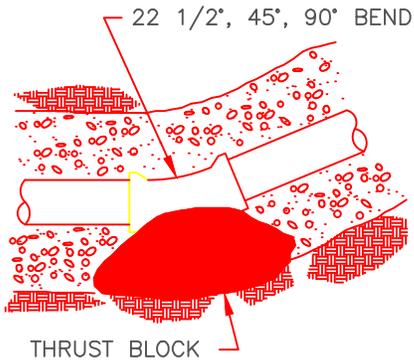


CURB STOP NOTES:

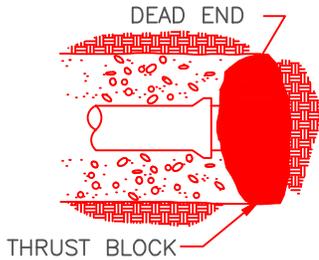
1. CURB STOPS SHALL HAVE A MINIMUM COVER OF SIX (6) FEET MEASURED FROM THE EXISTING GROUND SURFACE, EXCEPT THAT COVER SHALL BE MEASURED FROM C OF STREET GRADE WHEN SERVICE LINES ARE LAID TO A STREET SIDE WHICH HAS AN UPHILL SLOPE.
2. WATER SERVICE LINE SIZE AND MATERIAL MAY VARY. COPPER SERVICES SHALL BE DIRECTLY CONNECTED TO THE CURB STOP. OTHER SERVICE LINE MATERIALS SHALL BE CONNECTED WITH APPROPRIATE COMPRESSION COUPLERS.
3. BEDDING SHALL BE 1" # MAXIMUM WITHIN 6" OF SERVICE PIPE.
4. THE MAXIMUM SOD PAY AREA SHALL BE 3 S.Y. PER INSTALLATION. THE MAXIMUM SOD PAY AREA FOR METER PIT INSTALLATION WITH A CURB STOP SHALL BE 4.5 S.Y.

Malmstrom AFB
Standard Drawings

CURB STOP DETAIL



THRUST BLOCK @ ELBOW



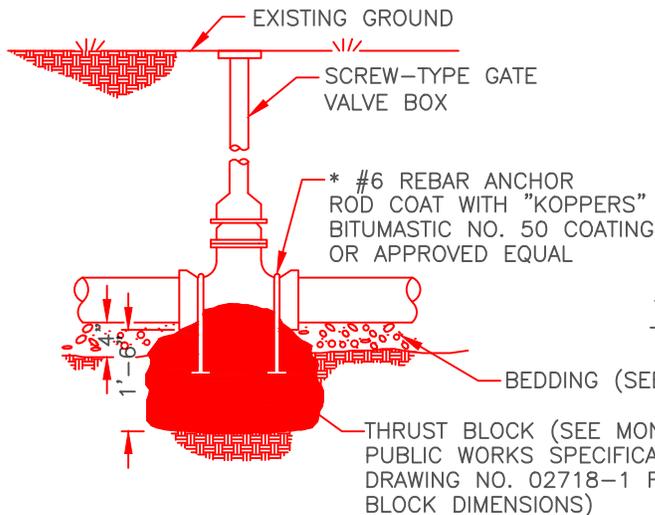
THRUST BLOCK @ DEAD END

PIPE SIZE	DEADEND OR TEE	90° ELBOW	45° & 22 1/2° ELBOW
1 1/2" TO 4"	2.0 SF	3.0 SF	2.5 SF
6"	4.0 SF	6.0 SF	3.0 SF
8"	8.0 SF	10.0 SF	5.0 SF
10"	12.0 SF	15.0 SF	8.0 SF
12"	16.0 SF	22.0 SF	12.0 SF
14"	21.0 SF	30.0 SF	17.0 SF
16"	28.0 SF	38.0 SF	21.0 SF

CONCRETE THRUST BLOCK BEARING AREAS

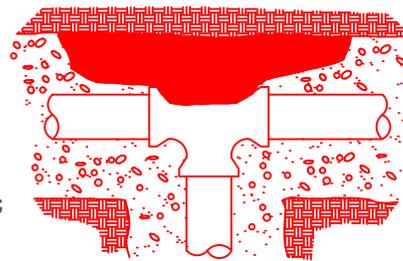
NOTE:

1. PROJECT INSPECTOR MAY CHANGE BEARING SURFACE AREA REQUIRED FOR A THRUST BLOCK.
2. THRUST BLOCK TO REST ONLY ON UNDISTURBED SOIL. CONTRACTOR MAY NEED TO ADD STABILIZATION (TYPE 2 BEDDING) IN ORDER TO ESTABLISH A STABLE SUPPORT FOR THRUST BLOCKING. ADEQUATE SUPPORT FOR THRUST BLOCKING IS CONTRACTOR'S RESPONSIBILITY.
3. USE ASPHALT BUILDING PAPER BETWEEN FITTING AND THRUST BLOCK.
4. KEEP CONCRETE CLEAR OF JOINT AND JOINT ASSEMBLY. PLYWOOD FORMING IS REQUIRED.
5. ALL C.I. FITTINGS TO BE POLY WRAPPED.
6. USE SAME BEARING SURFACE AREA OF A 22 1/2° BEND FOR A REDUCER FITTING.
7. CONCRETE SHALL DEVELOP A 3,000 P.S.I. MINIMUM COMPRESSIVE TEST AFTER 28 DAYS.



* FOR 6" TO 12" VALVE SIZE

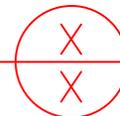
THRUST BLOCK @ VALVE



THRUST BLOCK @ TEE

HORIZONTAL THRUST BLOCKS

N.T.S.



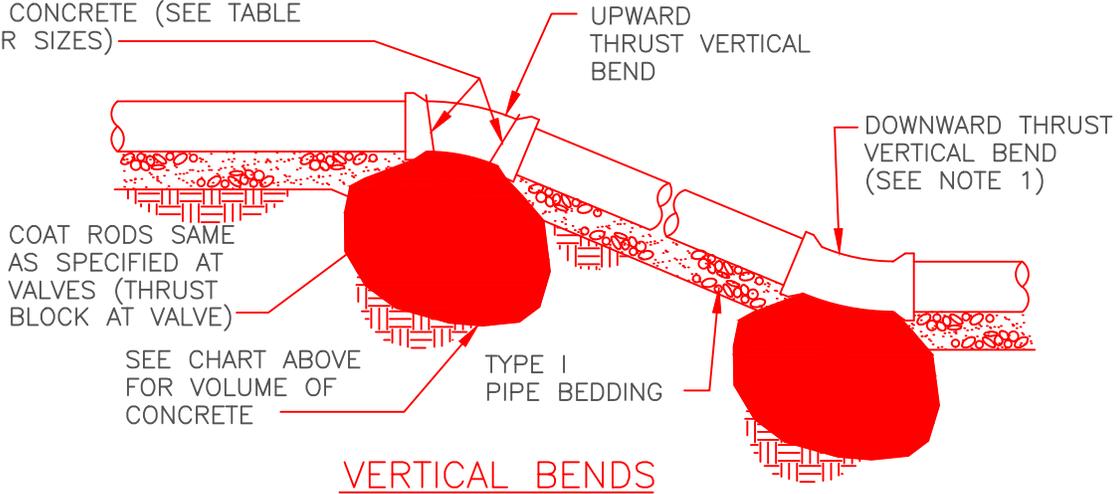
VOLUME OF THRUST BLOCK IN CUBIC YARDS (UPWARD THRUST VERTICAL BENDS)			
FITTING SIZE	BEND ANGLE		
	45°	22 1/2°	11 1/4°
1-1/2" TO 4"	1.1	0.4	0.2
6"	2.7	1.0	0.4
8"	4.0	1.5	0.6
10"	6.0	2.3	0.9
12"	8.5	3.2	1.3
14"	11.5	4.3	1.8
16"	14.8	5.6	2.3

FITTING SIZE	ROD SIZE	EMBEDMENT
12" AND LESS	#6	30"
14" - 16"	#8	36"

NOTE:

1. THRUST BLOCKS FOR DOWNWARD THRUST BENDS SHALL BE THE SAME SIZE (BEARING AREA SF) AS FOR HORIZONTAL BENDS.
2. PROJECT INSPECTOR MAY CHANGE VOLUME OF CONCRETE REQUIRED FOR A THRUST BLOCK.
3. ADEQUATE SUPPORT FOR THRUST BLOCKING IS CONTRACTORS RESPONSIBILITY.
4. USE ASPHALT BUILDING PAPER BETWEEN FITTING AND THRUST BLOCK.
5. KEEP CONCRETE CLEAR OF JOINT AND JOINT ASSEMBLY. PLYWOOD FORMING IS REQUIRED.
6. CONCRETE WILL BE 3,000 P.S.I. MINIMUM COMPRESSIVE TEST FOR 28 DAYS.

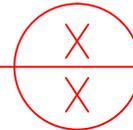
REBAR ANCHOR RODS AT FITTING AND EMBEDMENT IN CONCRETE (SEE TABLE FOR SIZES)



VERTICAL BENDS

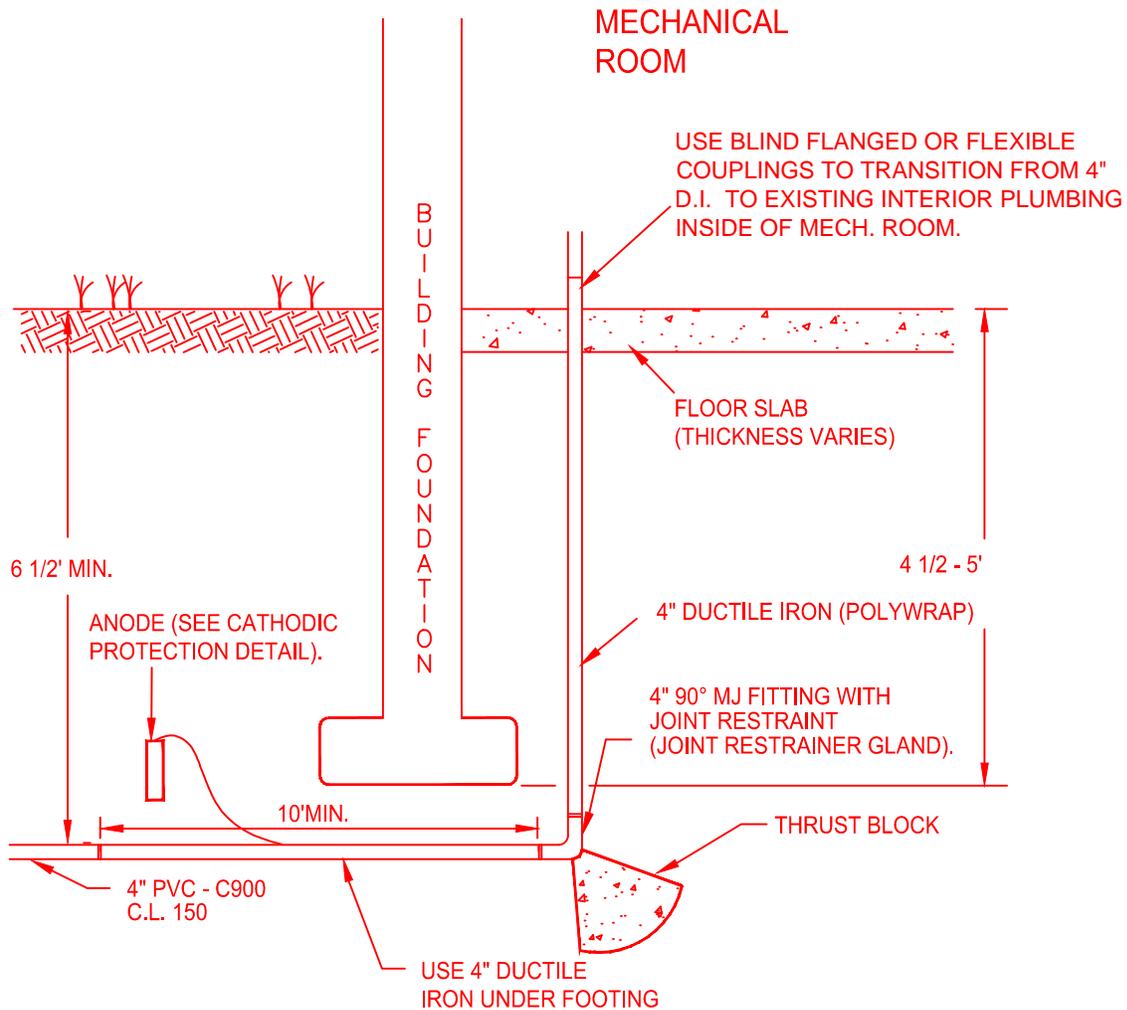
VERTICAL THRUST BLOCKS

N.T.S.



Malmstrom AFB
Standard Drawings

VERTICAL THRUST
BLOCKING DETAILS



1. REMOVE AND REPLACE EXISTING FLOOR SLAB AS NEEDED TO INSTALL NEW SERVICE. ALL CONCRETE SHALL BE REMOVED ALONG NEAT CUT LINES
2. ALL BACKFILL UNDER THE FOOTING AND INSIDE OF THE MECHANICAL ROOM SHALL BE NON-SHRINK SLURRY BACKFILL. ALLOW BACKFILL TO SET 24 HRS. BEFORE REPLACING CONCRETE

NON-SHRINK BACKFILL MIX

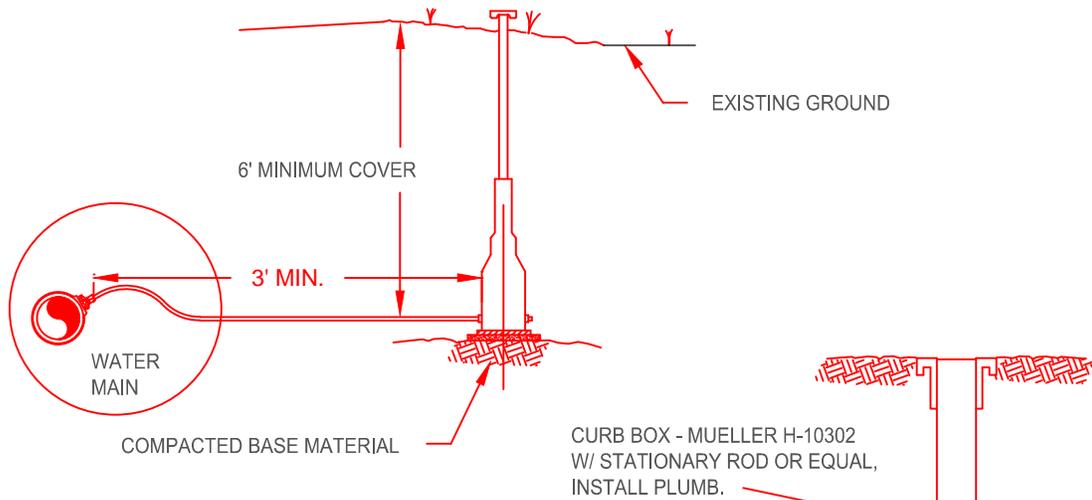
CEMENT	- 42 LBS
WATER	- 250 LBS
1" MINUS GRAVEL	- 1700 LBS
SAND	- 1845 LBS
	3837 LBS

WATER SERVICE CONNECTION (4" SVC.)

NO SCALE

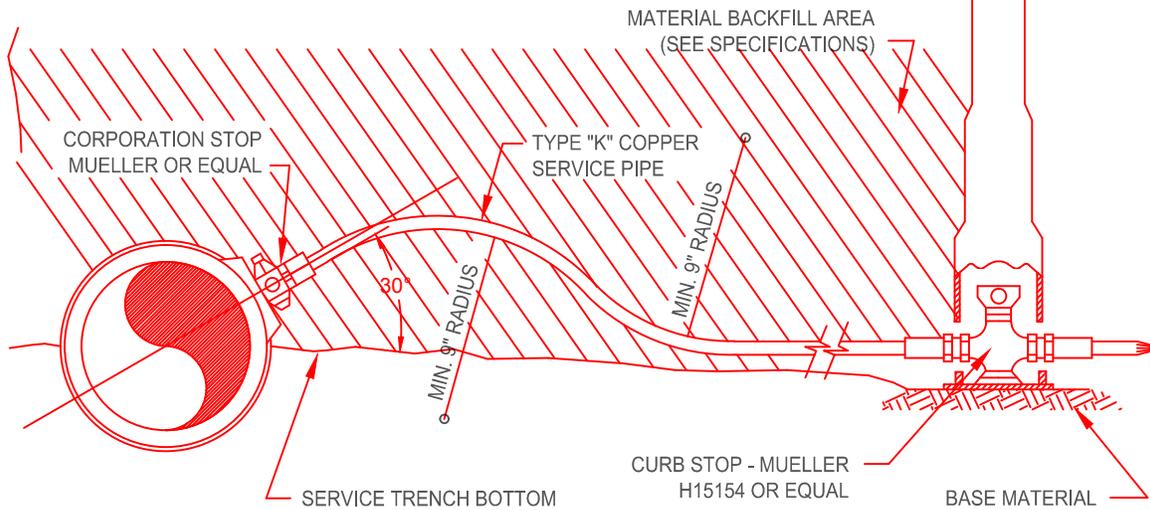
Malmstrom AFB
Standard Drawings

4" WATER SERVICE
CONNECTION DETAILS



GENERAL NOTES:

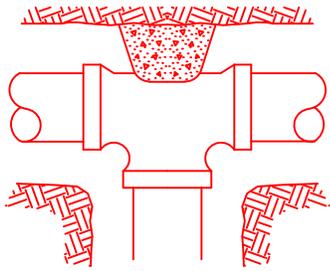
1. WATER SERVICE LINES SHALL HAVE A MINIMUM COVER OF SIX (6) FEET MEASURED FROM THE EXISTING GROUND SURFACE.
2. WATER SERVICE LINES SHALL BE INSTALLED WHERE SHOWN ON THE DRAWINGS OR AS SPECIFIED.
3. BEDDING SHALL BE 1"Ø MAXIMUM WITHIN 6" OF SERVICE PIPE.



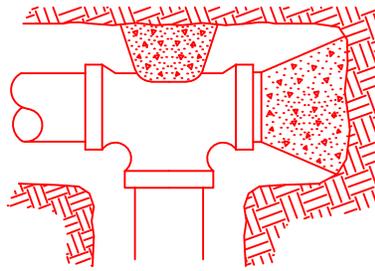
TYPE "K" COPPER WATER SERVICE

Malmstrom AFB
Standard Drawings

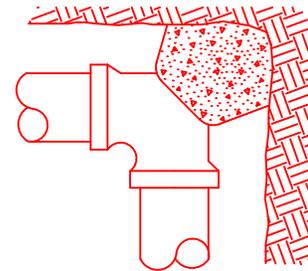
TYPE K WATER SERVICE
CONNECTION DETAILS



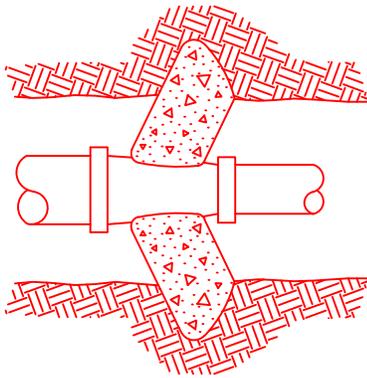
TEE



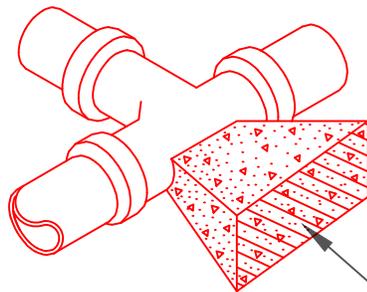
TEE (plugged)



BEND



REDUCER



THRUST BLOCK BEARING AREA
SEE TABLE FOR BEARING
AREA REQUIREMENTS.

THRUST BLOCK BEARING AREAS (SQ.FT.)				
PIPE SIZES	TEES & PLUGS	90° BEND	45° BEND & WYES	REDUCERS & 22-1/2° BEND
4"	1.8	2.6	1.4	0.8
6"	3.8	5.2	2.9	1.5
8"	6.7	9.5	5.0	2.6
10"	10.8	15.3	8.3	4.2
12"	15.3	21.8	11.9	5.8
14"	20.8	28.8	16.2	8.3
16"	27.4	37.7	20.9	10.8
18"	34.7	47.7	26.5	13.6
20"	42.8	58.9	32.7	16.8
24"	61.7	84.8	47.1	24.2
30"	96.4	132.5	73.6	37.9

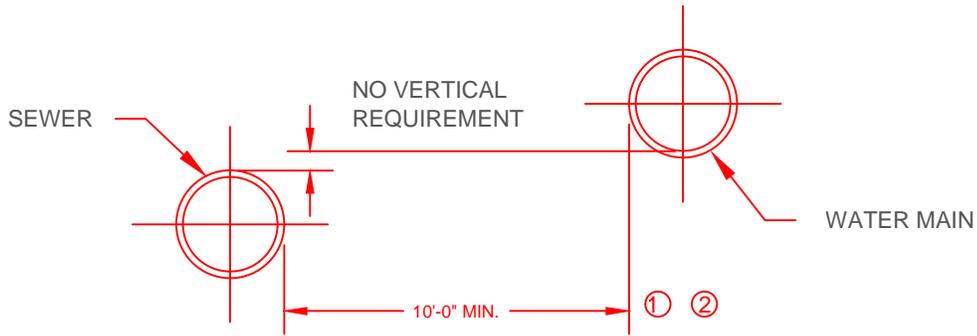
NOTE: 1. THIS TABLE IS BASED ON
150 PSI MAIN PRESSURE
2000 PSF SOIL PRESSURE.

2. WRAP ALL FITTINGS WITH
POLYETHYLENE.

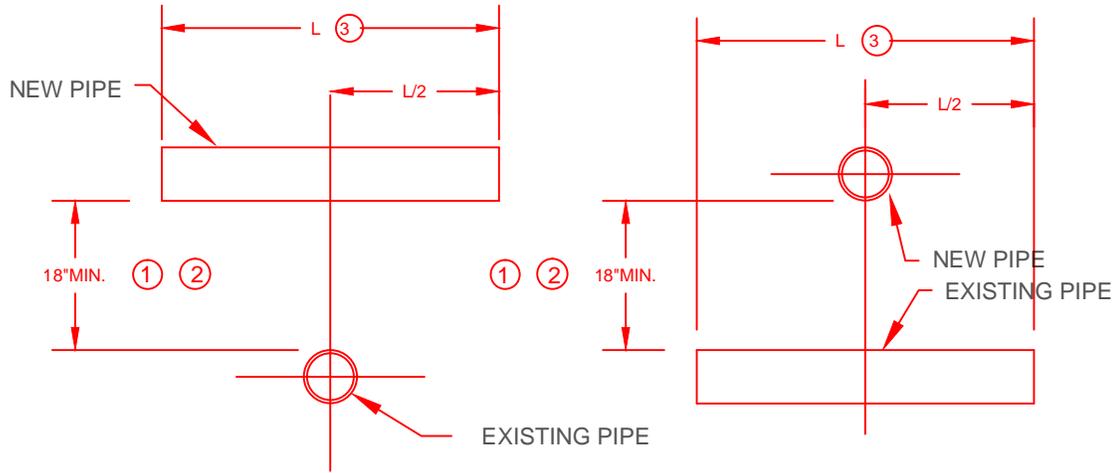
THRUST BLOCKING FOR WATER MAIN FITTINGS

Malmstrom AFB
Standard Drawings

THRUST BLOCKING FOR
WATER MAIN FITTINGS



PARALLEL ARRANGEMENT



CROSSINGS ④

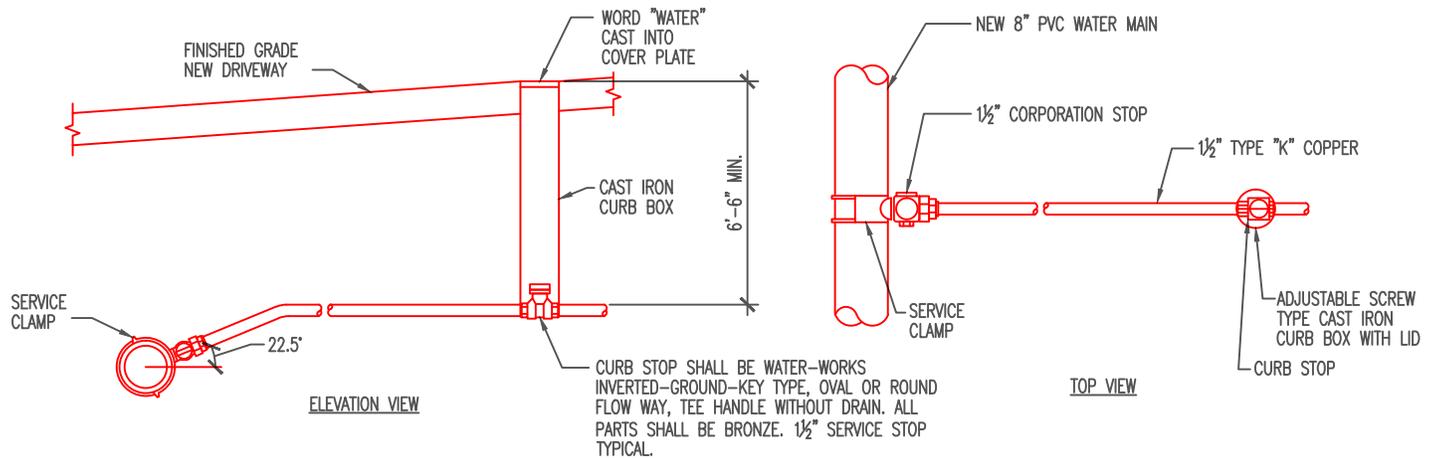
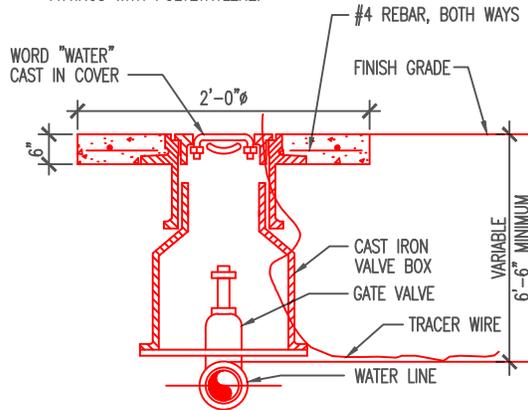
NOTES:

- ① NO EXCEPTION TO THE MINIMUM SEPARATION REQUIREMENT IS PERMITTED WHEN THE SEWAGE CARRYING PIPE IS A FORCE MAIN. AT CROSSINGS, ONE FULL LENGTH OF WATER MAIN PIPE SHALL BE LOCATED SO THAT BOTH JOINTS WILL BE AS FAR FROM THE FORCE MAIN AS POSSIBLE.
- ② LESS THAN 18 INCHES OF SEPARATION IS PERMITTED WHEN THE GRAVITY SEWER AT THE CROSSING IS MADE FROM A SINGLE 20 FOOT LENGTH OF AWWA PRESSURE PIPE AND THE CROSSING ANGLE IS APPROXIMATELY 90°.
- ③ "L" IS A STANDARD LENGTH OF PIPE AS SUPPLIED BY A PIPE MANUFACTURER.
- ④ ADEQUATE STRUCTURAL SUPPORT FOR PIPES AT CROSSINGS SHALL BE PROVIDED.

WATER AND SEWER MAIN SEPARATION

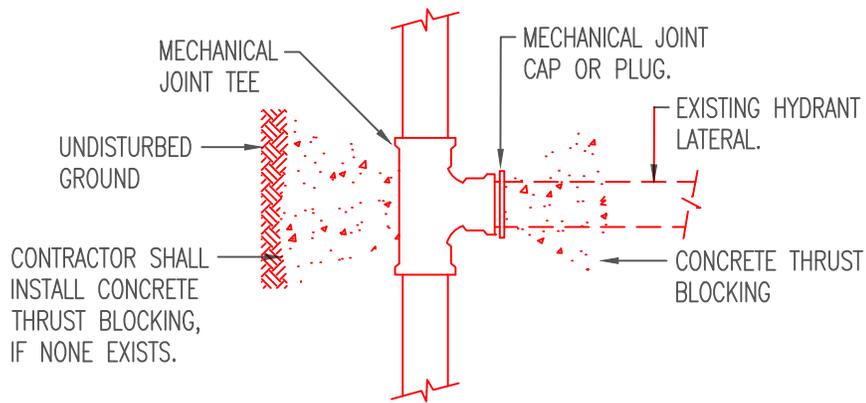
NOTES:

1. CAST IRON GATE VALVE SHALL BE CATHODICALLY PROTECTED. SEE ELECTRICAL FOR CATHODIC PROTECTION REQUIREMENTS.
2. CONCRETE COLLAR NOT REQUIRED IF VALVE IS LOCATED IN PAVED AREA OR CONCRETE SIDEWALK/SLAB.
3. WRAP VALVE AND VALVE BOX AND ALL WATER SYSTEM METALLIC FITTINGS WITH POLYETHYLENE.



Malmstrom AFB
Standard Drawings

CURB BOX
DETAIL



NOTES:

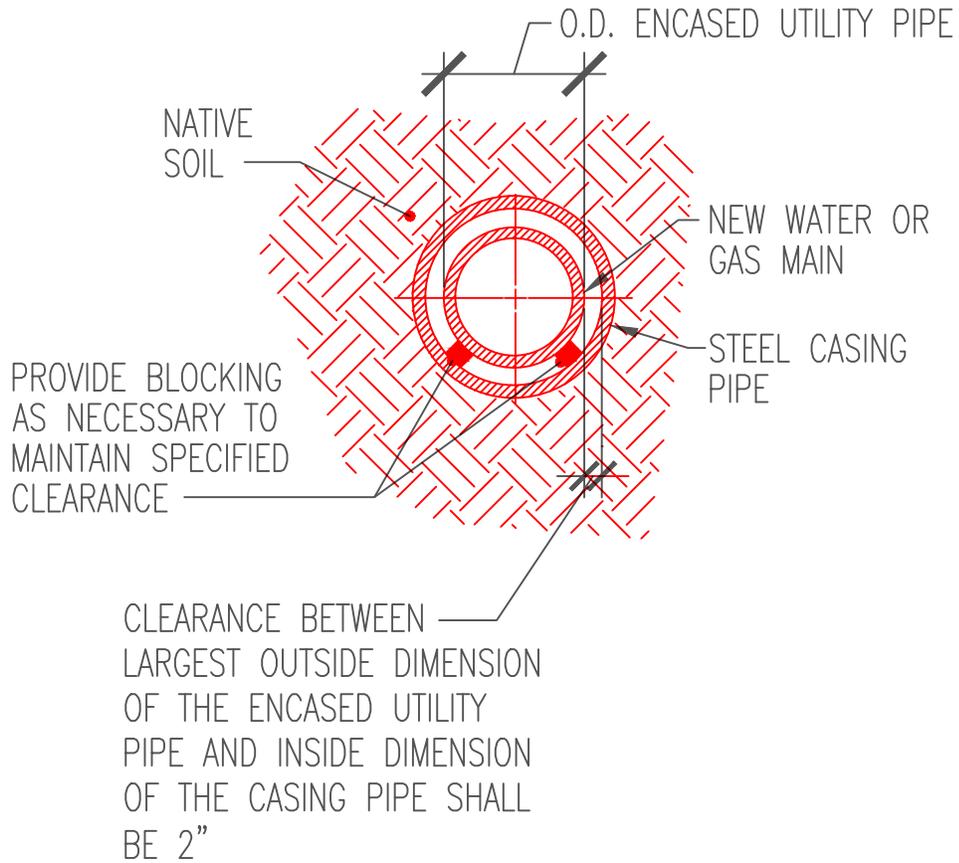
- 1) REMOVE THE EXISTING FIRE HYDRANT LATERAL (AND VALVE IF CONNECTED TO THE MAIN) FROM THE EXISTING MECHANICAL JOINT (OR FLANGED) TEE.
- 2) INSTALL A MECHANICAL JOINT (OR FLANGED) CAP OR PLUG.
- 3) INSTALL CONCRETE THRUST BLOCKING ON EITHER SIDE OF THE TEE AGAINST UNDISTURBED GROUND OR COMPACTED FILL.
- 4) SEE PROJECT SPECIFICATIONS FOR TREATMENT OF AC PIPE.

Malmstrom AFB
Standard Drawings

CAPPING DETAIL

GENERAL NOTES:

1. PIPE INSTALLED BY JACKING, BORING OR DIRECTIONAL DRILLING UNDER STREETS SHALL NOT WEAKEN OR DAMAGE ANY PART OF THE STREET.
2. THE FINAL INVERT OF THE UTILITY MUST BE AS INDICATED ON THE PLANS.



Malmstrom AFB
Standard Drawings

PIPE CASING DETAIL