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DEPARTMENT OF THE ARMY **CEGS-15060 (04/99)**
U.S. ARMY CORPS OF ENGINEERS ----------
Superseding
CEGS-15060 (11/98)

GUIDE SPECIFICATION FOR CONSTRUCTION

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DIVISION 15 - MECHANICAL

SECTION 15060

PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM

04/99

-- End of Section Table of Contents --

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SECTION 15060

PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM
04/99
Revised 30 Oct 2003

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NOTE: This guide specification covers the requirements for piping and valves for aircraft refueling systems as part of the Air Force Type III Standard (78-24-28-88). This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-700 for military construction and in accordance with ER 1110-2-1201 for Civil Works construction.
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PART 1 GENERAL

1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification. During the reference reconciliation process, SPECSINTACT will automatically remove references from this paragraph that have been removed from the text.
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Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1 (1988) Safety in Welding and Cutting

AMERICAN PETROLEUM INSTITUTE (API)

API SPEC 5L (1995) Line Pipe

API SPEC 6D	(1994) Pipeline Valves (Gate, Plug, Ball, and Check Valves)
API STD 607	(1993) Fire Test for Soft-Seated Quarter-Turn Valves
API STD 608	(1995) Ball Valves
API STD 1529	(1989) Aviation Fueling Hose
API RP 1110	(1991) Pressure Testing of Liquid Petroleum Pipeline

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-16	(1992; Addenda Dec 1992, Dec 1992, Dec 1994) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels DIVISION 1
ASME-17	(1992; Addenda Dec 1992, Dec 1993, Dec 1994) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1981; R 1992) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987) Square and Hex Nuts (Inch Series)
ASME B31.1	(1995) Power Piping
ASME B31.3	(1990; B31.3a-1990; Errata; B31.3b-1991) Chemical Plant and Petroleum Refinery Piping

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM A53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A105	(1996) Forgings, Carbon Steel, for Piping Components

ASTM A181	(1995b) Carbon Steel Forgings, for General Purpose Piping
ASTM A182	(1996e) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193	(1996b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	(1996) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A234	(1996a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A269	(1996) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	(1991c) Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A358	(1995) Electric-Fission-Welded Austonitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
ASTM A403	(1996) Wrought Austenitic Stainless Steel Piping Fittings
ASTM D229	(1991) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM E94	(1991) Radiographic Testing
ASTM F436	(1991) Hardened Steel Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1989) Welding Terms and Definitions Including Terms for Brazing, Soldering, Thermal Spraying and Thermal Cutting
AWS A5.1	(1991) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.4	(1981) Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes
AWS A5.5	(1981) Low-Alloy Steel Covered Arc Welding Electrodes

FEDERAL SPECIFICATIONS (FS)

FS L-C-530	(Rev C) Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
FS L-T-1512	(Rev A; Reinst) Tape, Pressure Sensitive Adhesive, Pipe Wrapping

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1988) Pipe Hangers and Supports-Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports-Selection and Application

MILITARY SPECIFICATIONS (MS)

MS MIL-C-4556	(Rev E) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MS MIL-N-5877	(Rev E) Nozzle, Pressure Fuel Servicing, Locking, Type D-1, D-2, D-2R Nominal 2-1/2 inch diameter
MS MIL-V-12003	(Rev F; Am 1) Valves Plug: Cast Iron or Steel, Manually Operated
MS MIL-S-13789	(Rev D) Strainers, Sediment: Pipeline, Basket Type
MS MIL-P-24441/GEN	(Rev B; Am 1, Supple 1) Paint, Epoxy-Polyamide

MILITARY STANDARDS (MIL-STD)

MIL-STD-161	(Rev F; Notice 2) Bulk Petroleum Products System Including Hydrocarbon Missile Fuels
MIL-STD-271	(Rev F) Nondestructive Testing Methods
MIL-STD-24484	(Rev J) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(1990) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 514	(1989) Hydraulic Tube Fittings, Standard

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 3 (1989) Power Tool Cleaning

SSPC SP 5 (1991) White Metal Blast Cleaning

1.2 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.

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Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Piping; GA.

Fittings; GA.

Valves; GA.

Flexible Ball Joints; GA.

Strainers; GA.

Flexible Hoses; GA.

Lightning Surge Arrester; GA.

Epoxy Lining; GA.
(Coating)

Protective Coatings; GA.

Sample Connections; GA.

Isolating Gasket Kits; GA.

Gaskets; GA.

Purge Blocks; GA.

Manufacturer's Catalog Data

SD-08 Statements

Qualifications of Welders; FIO.

SD-09 Reports

Pneumatic Test; FIO.

Hydrostatic Test; FIO.

SD-13 Certificates

Pipe; FIO.

Fittings; FIO.

Valves; FIO.

Pipe/Fitting Inspector-Owners (factory); FIO.

Pipe Weld Radiograph Inspector's Certification; FIO (for field welds).

Surface Preparation; FIO (interior).

Epoxy Coating and Application; FIO.

Isolating Gasket Kits; FIO.

Epoxy Manufacturer's Representative's certification; FIO.

Survey of final elevation of buried fuel pipe; FIO.

Survey giving elevation at each joint, elbow, and tee.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manuals; GA.

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 FACILITY OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Manual Valves
Flexible Ball Joints
Strainers
Protective Coatings
Sample Connections
Isolating Gasket Kits
Gaskets
Flexible Hoses

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Design conditions shall be as specified in Section 15050 MECHANICAL EQUIPMENT, FUELING SYSTEM.

2.2 MATERIALS

2.2.1 General

Pipe and fittings in contact with fuel shall be stainless steel, interior epoxy coated carbon steel as indicated on the drawings. No zinc coated metals, brass, bronze or other copper bearing alloys shall be used in contact with the fuel. All carbon steel and stainless steel underground piping shall have a protective coating and shall be cathodically protected in accordance with Section [13111 CATHODIC PROTECTION BY IMPRESSED CURRENT] [13112 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)]. Identification of piping shall be in accordance with MIL-STD-161 unless specified otherwise. Material for manual valves shall be as specified hereinafter.

2.2.2 Carbon Steel Piping

Each length of pipe shall be subjected to factory hydrostatic testing and ultrasonic testing in accordance with their respective pipe specification.

a. Piping 12-Inches and Larger: Seamless, ASTM A53 Grade B having a wall thickness of 0.375-inch.

b. Piping 2 1/2-Inches through 10-Inches: Seamless, Schedule 40 API SPEC 5L Grade B or ASTM A53 Grade B.

c. Piping Two-Inches and Smaller: Seamless, Schedule 80 API SPEC 5L Grade B or ASTM A53 Grade B.

d. Welding Electrodes: E70XX low hydrogen electrodes conforming to AWS A5.1 or AWS A5.5.

2.2.2.1 Interior Epoxy Coated Carbon Steel Piping

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NOTE: PIPE SMALLER THAN 3-INCHES CAN NOT BE COATED.
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Interior epoxy coating system shall be factory applied and in accordance with MS MIL-C-4556, six to eight mils dry film thickness. Documentation of conditions during application shall be submitted to the Contracting Officer. Before applying the epoxy coating, the inside of the pipe shall be sandblasted to "white" metal conforming with SSPC SP 5. If the pipe is not internally epoxy lined immediately after cleaning, a rust preventative coating shall be applied. The rust preventative shall be approved by the epoxy manufacturer. The ends of the pipe shall be masked or wiped back a minimum of one inch but not more than one and one-half inches. After the top coat has cured, the internal epoxy lining shall be tested electrically using an approved holiday detector and shall be free of holidays. The ends of the pipe shall then be capped. The shop doing the application shall have a minimum of five years of experience at applying internal epoxy coating. The application and holiday testing at the shop shall be available for inspection at any time by the Contractor or Contracting Officer. The shop shall notify the Contractor and the Contracting Officer at least one week before the pipe and fittings will be cleaned and epoxy coated. The Contractor shall provide a certified technical representative of the epoxy manufacturer to make at least three separate inspection trips with at least one day in the shop per trip. Each trip report shall be submitted to the Contracting Officer.

2.2.3 Stainless Steel Piping

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NOTE: A CYCLIC FATIGUE ANALYSIS MUST BE PERFORMED BY THE DESIGNER TO DETERMINE WALL THICKNESS OF WELDED PIPE. THE MINIMUM WALL THICKNESS THAT WELDED PIPE CAN BE IS THE SCHEDULE 20 THAT IS LISTED IN TABLE A. PRESSURES FOUND IN THE SURGE ANALYSIS WILL BE USED.
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a. Piping 2 1/2-Inches and Larger:

(1) ASTM A358, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A312 Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM shall include the Contracting Officer as a party to the agreement. All piping welds will receive 100 percent radiographic inspection, 100 percent liquid penetrant inspection, 100 percent visual inspection and all tests as required by the applicable ASTM Standard. Piping shall be provided with a nominal wall thickness as shown in Table A for ASTM A358 with the deviation from the nominal wall thickness less than 0.01-inch. ASTM A312 seamless piping shall be provided with a minimum schedule 10S wall thickness.

(2) Pipe Ends: All Piping shall be provided with beveled ends per Chapter V, ASME B31.3, and shall be shipped with the ends capped.

(3) Seam and End Welds: All sections of the piping provided shall be accepted on the project site if the seam welds meet the requirements of the paragraph K341 of ASME B31.3 and Appendix 4 of ASME-16. One hundred spots may be reinspected at the project site prior to installation and backfilling at the request of the Contracting Officers Representative. End welds shall be properly aligned prior to welding per Chapter V of the ASME B31.3. Welds found to be defective shall be repaired as per Chapter V of the ASME B31.3 at no additional cost to the government. Observation by the Contracting Officers Representatives of the manufacturing and field procedures shall be allowed under this contract.

(4) Welders Qualifications: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME-17. Welding procedures qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

(5) Factory Testing and Inspection Records: Per Table K341.3.2A of Chapter VII of ASME B31.3, visual, radiographic and liquid penetrant tests shall be performed for each section of piping provided as all sections are

subjected to cyclic conditions. All testing and inspections records shall be submitted to the Contracting Officers Representative and shall indicate the pipe mark and installed location of what piping section on the project site. Observation by the contracting Officers Representatives of the manufacturers and the fields testing and inspection procedures shall be allowed under this contract. Pipe certification along with pipe markings shall be submitted before the pipe arrives on the job site.

(6) Welding Inspectors for Stainless Steel Piping: The contractor shall submit the qualifications of all the testing personnel that will perform all field tests as requested by the Contracting Officer. The qualifications of all personnel on the job site that will perform welding inspection shall be submitted for approval. These inspectors shall meet the qualifications as defined in Chapter VI of the ASME B31.3, and may use the methods as defined in Table K341.3.2 B of the ASME B31.3.

(7) The Contractor shall provide a qualified inspector in accordance with Chapter VI of ASME B31.3. to act as the owner's inspector (for the Government) at the pipe manufacturer's facility in addition to the manufacturer's inspector.

(8) Quality Assurance Plan shall be submitted for the welding, inspecting and testing of the welded seam pipe.

TABLE A

Nominal Pipe Size	Nominal (Average) Pipe O.D.	Wall Thickness(tn)
16 in.	16.000 in.	0.312 in.
14 in.	14.000 in.	0.312 in.
12 in.	12.750 in.	0.250 in.
10 in.	10.750 in.	0.250 in.
8 in.	8.625 in.	0.250 in.
6 in.	6.625 in.	0.219 in.
4 in.	4.500 in.	0.219 in.
2 1/2 in.	2.875 in.	0.156 in.

b. Piping Two-Inches and Smaller: Schedule 80 ASTM A312 seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A312 seamless Type 304L for welded piping.

c. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A269, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.

d. Welding Electrodes: E308L conforming to AWS A5.4.

2.2.4 Protective Coatings for Aboveground Carbon Steel Piping

Provide coating of aboveground piping, piping in pits, pipe supports, filter separators, and miscellaneous metal and equipment in accordance with MS MIL-P-24441/GEN and the instructions that follow. Color of finish coat shall be white. Do not paint stainless steel or aluminum surfaces. Surfaces including those that have been shop coated, shall be solvent

cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with power tools according to SSPC SP 3. Cleaning shall be performed in sections or blocks small enough to permit application of the epoxy-polyamide prime coat during the same work shift. Shop-coated surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

2.2.4.1 Coating Description

Epoxy-polyamide coatings consist of a two component system that includes a pigmented polyamide resin portion (A component) and an epoxy resin portion (B component). Once they are mixed together and applied as a paint film, the coating cures to a hard film by chemical reaction between the epoxy and polyamide resins. Epoxy-polyamide coating (MS MIL-P-24441/GEN) consists of individual formulations, for example, Formula 150 is for green primer, and Formula 152 is for white topcoat.

2.2.4.2 Mixing Epoxy-Polyamide Coatings

Epoxy-polyamide coatings are supplied in measured amounts that must be mixed together in exact proportions to ensure the correct and complete chemical reaction. Mix no more paint than can be applied in the same day. The estimated pot life is 3-4 hours for 5 gallons at 70-80° F. Discard any mixed paint remaining at the end of the day.

a. Mixing Ratio. The mixing ratio of the MS MIL-P-24441/GEN coatings (except Formula 159) are all 1:1 by volume, for example, 5 gallons of component A to 5 gallons of component B. The mixing ratio of MS MIL-P-24441/GEN for formula 159 is 1:4 by volume.

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NOTE: The individual A and B components of the various formulas are not interchangeable.

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b. Mixing Procedures. Each component shall be thoroughly stirred prior to mixing the components together. After mixing equal volumes of the two components, this mixture shall again be thoroughly stirred until well blended. The induction time shall be adhered to, to ensure complete chemical reactions. Induction time is defined as the time immediately following the mixing together of components A and B during which the critical chemical reaction period of these components is initiated until the mixture is ready for application. This reaction period is essential to ensure the complete curing of the coating. Volumetric mixing spray equipment with in-line heaters set at 70 to 80° F (21 to 28° C) may be used without an induction period.

2.2.4.3 Induction Times

The temperature of the paint components in storage should be measured to determine induction time and pot life. Pot life is the usable life of the mixed paint. It is dependent upon the temperature and the volume of the mixed paint. The pot life of a five gallon mixture of the MS MIL-P-24441/GEN paints at 70-80EF is approximately 4 hours. The job site application temperature will affect the time required for the paint to cure, and must be considered in estimating induction time, cure time, and the effect of batch size on these functions. At 40 to 60° F a 1 hour

induction time shall be used. Volumetric mixing spray equipment with in-line heaters set at 70 to 80° F may be used without an induction period. To ensure that the reaction proceeds uniformly, the paint should be manually stirred periodically during its induction period. This prevents localized overheating or hot spots within the paint mixture.

2.2.4.4 Epoxy-Polyamide Coating Application

Epoxy-polyamide coatings, MS MIL-P-24441/GEN, may be applied by brushing or spraying.

a. Thinning Application. Ordinarily, MS MIL-P-24441/GEN coatings are not thinned. If necessary, up to one pint of epoxy thinner for each gallon of mixed paint may be added if paint has thickened appreciably during cold temperature application or if necessary to improve application characteristics. When applied at the proper thickness, without thinning, these paints will have no tendency to sag.

b. Application Thickness. Unless otherwise specified, apply each coat of paint to produce approximately 3 mils dry film thickness (DFT). Application which yields in excess of 4.0 mils DFT should be avoided to prevent sagging.

c. Spray Application. MS MIL-P-24441/GEN paints should be sprayed with conventional spray guns and normal spray-pot pressures. The spray gun should be equipped with a middle-size (D) needle, and nozzle setup. Both conventional and airless spray equipment are suitable for use with or without volumetric mixing capability.

2.2.4.5 Equipment Cleanup

The mixed paint should not be allowed to remain in spray equipment for an extended period, especially in the sun of a warm area. The paint cures more rapidly at higher temperatures. When components A and B are mixed together, the pot life of the mixture (including the induction time is 6 hours at 70° F (21° C). Pot life is longer at lower temperatures and shorter at temperatures above 70° F (21° C). Spray equipment should be cleaned after using by flushing and washing with epoxy thinner or aromatic hydrocarbon thinners (xylene or high flash aromatic naphtha). General cleanup is also done by using these solvents. Brushes and rollers should be given a final cleaning in warm soapy water, rinsed clean with warm fresh water and hung to dry.

2.2.5 Protective Coatings for Buried Steel Piping

Provide pipe with FS L-C-530 coating system of factory-applied adhesive undercoat and continuously extruded plastic resin coating; minimum thickness of plastic resin shall be 36 mils for pipe sizes 6 inches and larger. Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations shall be clean, dry, grease free, and primed before application of tape. Tape shall overlap the pipe coating not less than three inches. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than six inches. Pipe coating and adhesive undercoat surfaces to be wrapped with tape shall be primed with a compatible primer prior to application of tape. Primer shall be as recommended by tape

manufacturer and approved by pipe coating manufacturer.

a. Damaged Areas of Pipe Coating: Provide FS L-T-1512, 20 mils nominal thickness of tape over damaged areas. Residual material from damaged areas of pipe coating shall be pressed into the break or trimmed off. Apply tape spirally with one-third overlap as tape is applied. A double wrap of one full width of tape shall be applied at right angles to the axis to seal each end of the spiral wrapping.

b. Fittings, Couplings, and Regular Surfaces: Provide FS L-T-1512, 10 mils nominal thickness tape overlapped not less than 1.0 inch over damaged areas. Initially stretch and apply first layer of tape to conform to component's surface. Then apply and press a second layer of tape over first layer of tape.

c. Testing of Protective Coatings: Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester shall be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 1,000 times the square root of the average coating thickness in mils. Tester shall be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer shall be required at six-month intervals or at such time as crest voltage is questionable. Certify in writing the calibration date and crest voltage setting. Maintain the battery at ample charge to produce the crest voltage during tests. Areas where arcing occurs shall be repaired by using material identical to original coating or coating used for field joints. After installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays.

2.2.6 Fittings

2.2.6.1 General

Welding ells, caps, tees, reducers, etc., to be of materials compatible for welding to the pipe line in which they are installed, and wall thickness, pressure and temperature ratings of the fittings shall be not less than the adjoining pipe line. Unless otherwise required by the conditions of installation, all elbows shall be the long radius type. Miter joints shall not be acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings to be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings will not be permitted. Welding branch fittings shall be insert type suitable for radiographic inspections specified herein.

2.2.6.2 Carbon Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld, conforming to ASTM A234, grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe. All welds shall be radiographically examined throughout the entire length of each weld. Each fitting shall be subjected to the Supplementary Requirements S3 and S4, Liquid Penetration examination and Magnetis-Particle Examination. Detectable flaws will not be accepted in the supplementary examinations. Fittings shall be identified to relate them to their respective radiograph.

b. Fittings 2 Inches and Smaller. Forged (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G., conforming to ASTM A105, Grade 2 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Flanges: One-hundred-fifty-pound weld neck, forged flanges conforming to ASTM A181, Grade 2, and ASME B16.5. Flanges to be 1/16-inch raised face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flange face shall be machined to match valves or equipment furnished. Use of spacing rings or gaskets discs are not allowed. Flanges shall be subjected to the Supplementary Requirements S4 and S5, Liquid Penetrant Examination, and Magnetic-Particle Examination. Detectable flaws will not be accepted.

d. Interior Epoxy Coating System shall be applied to the fittings as specified in paragraph "Carbon Steel Piping."

2.2.6.3 Stainless Steel Fittings

a. Fittings 2-1/2 Inches and Larger: Butt weld stainless steel conforming to ASTM A403, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings shall be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe.

b. Fittings 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G. conforming to ASTM A182 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground low point drain pipe and high point vent pipe shall be butt welded.

c. Unions. Conforming to ASTM A312, Grade 304 or 316.

d. Flanges. One-hundred-fifty-pound weld neck, forged Type 304 or 304L stainless steel flanges conforming to ASTM A182 and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps shall be 300-pound. Flanges to be 1/16-inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flanges shall be subjected to the Supplementary Requirements S4, Liquid Penetrant Examination.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J 514.

2.2.6.4 Isolating Gasket Kits (Insulating) for Flanges

Provide ASTM D229 electrical insulating material of 1,000 ohms minimum resistance; material shall be resistant to the effects of aviation

hydrocarbon fuels. Provide full face insulating gaskets between flanges. Provide full surface 0.03-inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125-inch thick high-strength phenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Exterior above grade flanges separated by electrically isolating gasket kits shall be provided with weatherproof lightning surge arrester devices. The surge arrester shall bolt across flanges separated by insulating gasket kits per detail on contract drawings. The arrestor shall have the following features:

a. Weatherproof NEMA 4 enclosure.
b. Bidirectional and bipolar protection.
c. Constructed of solid state components, no lights, fuses or relays shall be used that will require maintenance or replacement.
d. Withstand unlimited number of surges at 50,000 Amperes.
e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).
f. A UL listed arrester for installation in Class 1, Division 2, Group D, hazardous areas is preferred if available.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule.

Line Size (Inches)	Bolt Size (Inches)
2	5/8
2-1/2	5/8
3	5/8
4	5/8
6	3/4
8	3/4
10	7/8
12	7/8
14	1
16	1

(Note: Allowance must be made for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.)

2.2.7 Bolts and Nuts

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193, Grade B7. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Nuts shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194, Grade 8. Nuts shall be threaded in accordance with ASME B1.1,

Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Provide washers under bolt heads and nuts. Washers to be ASTM F436, flat circular stainless steel. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer. Anti-seize compound shall be used on stainless steel bolts.

2.2.8 Gaskets

ASME B16.21, composition ring, using a Buna-N binder, 0.1250-inch thick. Gaskets shall be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets shall be used for flat-face flanged joints. Ring gaskets shall be used for raised-face flanged joints. Gaskets shall be of one piece factory cut.

2.2.9 Relief and Drain System Piping

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NOTE: PER COMMAND FUELS FACILITY ENGINEER.
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Pressure relief valve discharge lines and drain lines to the product recovery tank shall be Schedule 40 [API SPEC 5L Grade B or ASTM A53 Grade B Carbon Steel][ASTM A312 seamless Type 304L Stainless Steel].

2.2.9.1 Gaskets

See Gaskets specified herein before.

2.2.10 Relief and Drain System Protective Coating

Pipe shall be factory coated as specified herein before for steel piping.

2.2.11 Field Applied Protective Coatings

The field joints and fittings of all underground piping shall be coated as herein specified.

2.2.11.1 Welded Joints

Heat shrinkable radiation-cross-linked polyolefin wraparound type sleeves shall be applied to all welded joints. Joints shall not be coated until pressure testing is complete. Apply sleeves consisting of 40 mil polyolefin backing and 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.2.11.2 Fittings

Fittings and other irregular surfaces shall be tape wrapped. The tape shall be a plastic mastic laminated tape having 6 mil plastic backing of either polyethylene or polyvinylchlorine and 29 to 44 mil of synthetic elastomer.

2.2.12 Threaded Joints

Threaded joints, if indicated on the drawings, shall be made tight with manufacturer recommended teflon tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to

the male threads. Not more than three threads shall show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping. Threaded joints shall not get welded.

2.2.13 Welded Joints

Welded joints in steel pipe shall be as specified in Part 3 "EXECUTION."

2.3 MANUAL VALVES

All portions of a valve coming in contact with fuel in stainless steel pipe lines shall be of noncorrosive material. Valves in stainless steel pipe lines shall be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Stem and trim shall be stainless steel for all valves. Manually operated valves six inches and larger shall be worm-gear operated and valves smaller than six inches shall be wrench operated. Valves smaller than two inches shall have lever-type handles. Valves installed more than eight (8) feet above finished floor shall have chain operators and a position indicators visible from ground level. Sprocket wheel for chain operator shall be aluminum.

2.3.1 Ball Valves

Ball valves shall be fire tested and qualified in accordance with the requirements of API STD 607 and API STD 608. Ball valves shall be nonlubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves two inches and larger shall conform to applicable construction and dimension requirements of API SPEC 6D, ANSI Class 150 and shall have flanged ends. Valves smaller than 2 inches shall be ANSI class 150 valves with one piece bodies with flanged ends, unless noted otherwise. The balls in valves 10 inches full port and 12 inch regular port and larger shall have trunnion type support bearings. Except as otherwise specified, reduced port or full port valves may be provided at the Contractor's option.

2.3.1.1 Materials

Ball shall be stainless steel. Ball valves shall have tetrafluoroethylene (TFE) or Viton seats, body seals and stem seals. Valves 2 inches and smaller shall have a locking mechanism.

2.3.2 Plug (Double Block and Bleed) Valves

API SPEC 6D, Type III, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve shall have stainless steel or carbon steel body with chrome-plated interior, tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower . Sealing slips shall be steel or ductile iron, with Viton seals which are held in place by dovetail connections. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves shall have weatherproof operators with mechanical position indicators. Minimum bore size shall be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal or better flow characteristics of the reduced bore size design.

2.3.2.1 General

Valves in the operating tank suction lines shall be provided with a factory-installed limit switch that is actuated by the valve closure. Each switch shall have one double pole double throw contacts, and shall be watertight and U.L. listed for Class I, Division 1, Group D hazardous areas with (T2D-419 F) temperature limitation.

2.3.2.2 Valve Operation

Rotation of the handwheel toward open shall lift the plug without wiping the seals and retract the sealing slips so that during rotation of the plug clearance is maintained between the sealing slips and the valve body. Rotation of the handwheel toward closed shall lower the plug after the sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, the slips shall form a secondary fire-safe metal-to-metal seat on both sides of the resilient seal. Plug valves located in Isolation Valve Pits shall be provided with handwheel extensions.

2.3.2.3 Relief Valves

ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves shall open at 25 psi differential pressure and shall discharge to the throat of, and to the upstream side, of the plug valve.

2.3.2.4 Bleed Valves

ANSI Class 150, stainless steel body valve. Provide manually operated bleed valves that can be opened to verify that the plug valves are not leaking when in the closed position.

2.3.3 Swing Check Valves

Swing check valves shall conform to applicable requirements of API SPEC 6D, regular type, ANSI Class 150 with flanged end connections. Check valves shall be tilting disc, non-slam type with 316 stainless steel body and trim. Discs and seating rings shall be renewable without removing the valve from the line. The disc shall be guided and controlled to contact the entire seating surface.

2.4 RELIEF VALVES

Relief valves shall be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and shall be labeled in accordance with ASME-16. Valve stems shall be fully guided between the closed and fully opened positions. The valves shall be factory-set to open at the set pressure indicated on the drawings. Operating pressure shall be adjustable by means of an enclosed adjusting screw. The valves shall have a minimum capacity of 20 GPM at 10 percent overpressure and shall operate at rated capacity with a back pressure not exceeding 50 psi. Valves shall have a replaceable seat.

2.4.1 Materials

Valves shall have carbon steel bodies and bonnets with stainless steel

springs and trim. Valves shall be Class 150 flanged end connections.

2.4.2 Sight Flow Indicators

Sight flow indicators shall be ANSI Class 150 and shall have flanged end connections. Sight flow indicators shall consist of a housing containing a rotating propeller that is visible through a glass observation port. The housing shall be stainless steel when installed in stainless steel lines and carbon steel when installed in carbon steel lines. The glass in the indicator shall also meet the Class 150 rating. The indicator down stream of the Pressure Control Valve (PCV) shall contain a bi-directional flapper instead of a propeller.

2.5 PIPING ACCESSORIES

2.5.1 Flexible Ball Joints

Flexible ball joints shall be stainless steel, capable of 360-degree rotation plus 15-degree angular flex movement, ASME B16.5, Class 150 flanged end connections. Provide pressure molded composition gaskets designed for continuous operation temperature of 275 degrees F. Joints shall be designed for minimum working pressure of ANSI Class 150.

2.5.2 Pipe Sleeves

Pipe sleeves shall be installed at all points where the piping passes through concrete construction. Such sleeves shall be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs shall be standard weight carbon steel pipe with a protective coating. Each sleeve shall extend through the respective pit wall or slab and shall be provided with a Buna-N casing seal. Sleeves where piping passes under roads or piping indicated to be double walled shall be standard weight carbon steel pipe with a protective coating as previously specified. Alignment of the sleeve and piping shall be such that the pipe is accurately centered within the sleeve by a nonconductive centering element. The sleeve shall be securely anchored to prevent dislocation. Closure of space between the pipe and the pipe sleeve shall be by means of a mechanically adjustable segmented elastomeric seal. The seal shall be installed so as to be flush.

2.5.3 Strainers

2.5.3.1 Basket Type

Strainer shall be in compliance with MS MIL-S-13789, except as specified otherwise. Strainer end connections shall be designed in accordance with ASME B16.5, Class 150. Strainers shall have stainless steel bodies, stainless steel shall be Types 304 or 316. Strainers shall have removable baskets of 60 mesh wire screen with larger wire mesh reinforcement; wire shall be stainless steel, Type 316. Pressure drop for clean strainer shall not exceed three psig at maximum design flow rate. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than three to one. Each strainer shall be provided with a suitable drain at the bottom, equipped with a ball valve. Strainer shall be the single inlet, single outlet design. Strainer shall be supplied with a piston type direct reading differential pressure gage as specified in SECTION 15880 FILTER SEPARATOR.

2.5.3.2 Cone Type (Temporary)

Strainer shall be stainless steel type 304 or 316, 60 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe shall be not less than one to one.

2.5.4 Pipe Hangers and Supports

2.5.4.1 General

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69. Supports shall be provided at the indicated locations. Support channels for drain lines shall be epoxy coated on all surfaces or hot-dip galvanized after the channels are cut to length. Coated supports shall be coated with fusion bonded epoxy resin applied by the fluidized bed method. Thickness of the coating shall be not less than 10 mils. Surface preparation and coating application shall be in accordance with the epoxy manufacturer's instructions. The coating shall be pinhole free when tested with a low voltage holiday detector set at no more than 100 times the mil thickness of the coating. All pinholes shall be marked, repaired and retested to ensure a pinhole free film. The coating material shall be a 100 percent solids, thermosetting, fusion-bonded, dry powder epoxy resin. The manufacturer shall certify that the material is suitable for fluidized bed application and that it is approved by the Environmental Protection Administration.

2.5.4.2 Adjustable Pipe Supports

Adjustable pipe supports shall consist of a cast iron saddle and a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-69. The supports shall be provided with neoprene insulation strips.

2.5.4.3 Low Friction Supports

Low friction supports shall be self-lubricating antifriction element composed of reinforced TFE. Units shall be factory designed and manufactured.

2.5.4.4 Concrete and Grout

Concrete and grout for anchors and supports shall comply with SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.5.5 Sample Connections

Sample connections shall be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection shall include a 1/4-inch sampling probe where the probe faces upstream, ball valve and 1/4-inch quick disconnect coupling with dust plug, all assembled into a unit that is suitable for installation in a pipe nipple. The sampling probe shall extend not less than one inch into the fuel pipe. All materials in the sample connections shall be stainless steel or aluminum.

2.5.5.1 Sampling Hoses

Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly shall consist of a six-foot length of 1/4-inch clear plastic tubing with internal bonding/grounding wire. One end of the

tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire shall be equipped with clips for attaching to the pipe and metal sample container.

2.5.6 Flanged Swivel Joints

Flanged swivel joints shall be capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Swivel joints shall be of the non-lubricated, maintenance free type with nonlubricated bearings and no lubricating fitting. Swivel joint shall be flanged at the end connecting to the piping system and threaded (female NPT) at the end connecting to the fuel hose. No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints shall be warranted for two years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps.

2.5.7 Monitoring Points

At the following locations, provide half-inch pipe, flanged ball valve, and blind flange for future test equipment connections:

a. At the outlet of the emergency shut-off valve in the pumphouse.

b. At the Hydrant Host Truck Checkout, inlet to Hydrant Valve.

c. At the inlet to the Back Pressure Control Valve in the Pumphouse.

d. At both sides of the isolation valve in all the isolation valve pits.

2.5.8 Fuel Hose

Fuel hose shall conform to API STD 1529, Grade 2, Type C, threaded, male NPT, both ends.

2.5.9 Pressure Fueling Nozzle

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NOTE: SPECIFY TYPE OF NOZZLE AS DIRECTED BY THE COMMAND FUELS FACILITY ENGINEER

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Nozzles shall conform to MS MIL-N-5877, Type [D-1][D-2]. Nozzles and nozzle components shall be compatible with the fuel to be handled. Nozzles shall be provided with an internal 60 mesh stainless steel strainer and a fuel sample connection tapping. Nozzle design shall be for single point fueling of aircraft. Nozzles shall be provided with a compatible dry break quick disconnect swivel. Coupler shall allow for quick disconnect and reconnect of fueling nozzles with corresponding adapters. Coupler and adapter shall provide a positive, leak proof connection under constant or surge flow. Coupler shall be designed to prevent blowout of internal poppet.

2.5.10 Nozzle Adapter (SPR)

Adapter shall be a nominal 2-1/2 inches with self-closing valve in accordance with MIL-STD-24484. Adapter shall have a 4 inch flange mounting and metal sealing, vacuum tight, locking dust cap using the SPR lugs.

2.6 FLEXIBLE HOSES

Flexible hoses for fueling pumps shall have ANSI Class 300 flanges of stainless steel construction conforming to ASME B16.5. Flexible hoses shall be of stainless steel flexible metal hose consisting of an inner corrugated stainless steel tube with stainless steel braid cover. All components to be suitable for not less than 275 psig. Length and application of flexible hoses shall be per manufacturer's written recommendations.

PART 3 EXECUTION

3.1 WELDING

3.1.1 General

All joints unless indicated otherwise, in carbon steel and stainless steel piping systems shall be welded. Unless otherwise approved, all girth welds shall be complete penetration groove welds made in accordance with qualified welding procedures. Welding operations, qualifications of welders and welding procedures shall comply with the provisions of ASME B31.3 and the requirements specified herein. The root pass on stainless steel and carbon steel pipe shall be by the GTAW process. During the root pass welding procedure, the weld surface on the pipe interior shall be shielded with an inert shielding or backing gas supplied from an externally supplied gas or gas mixture until it has cooled to the point that oxidation no longer can occur (shielding of root pass weld shall not be from flux-coated or cored welding rod). Purging, with inert gas, of the weld surface shall occur until the oxygen sensor indicates a value below 60 PPM before the root pass weld begins. Contractor shall submit ,for approval by the Contracting Officer, the root pass welding procedure including the details on the purge dam. All passes of each weld shall be made by the same welder.

a. Definitions shall be in accordance with AWS A3.0.

b. Symbols shall be in accordance with AWS A2.4 for welding and nondestructive testing, unless otherwise indicated.

c. Safety Precautions shall conform to ANSI Z49.1.

d. Weld Preparation shall comply with the requirements of ASME B31.3 and the qualified Welding Procedure Specification. The use of "rice paper" as purge blocks is not permitted. Contractor shall submit alternate method for approval.

e. Backing Rings. The use of backing rings for making or repairing welds will not be permitted.

3.1.2 Qualifications of Welders

Welders and welding procedures shall be qualified in accordance with requirements of ASME B31.3.

3.1.2.1 Weld Identification

Each qualified welder shall be assigned an identification symbol. All welds shall be permanently marked with the symbol of the individual who made the weld.

3.1.2.2 Defective Work

Welders found making defective welds shall be removed from the work or shall be required to be requalified in accordance with ASME B31.3.

3.1.3 Tests

All steel pipe field welds, including high point vent pipe and low point drain pipe, shall be examined by radiographic methods to determine conformance to the paragraph "Standards of Acceptance." The services of a qualified commercial or testing laboratory approved by the Contracting Officer shall be employed by the Contractor for testing of piping welds. Costs of testing, including retesting or repaired welds, shall be borne by the Contractor.

3.1.3.1 Radiographic Inspection

Procedures for radiographic inspection shall be in accordance with MIL-STD-271 or ASTM E94. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectional defect shall be removed by grinding or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface.

3.1.4 Standards of Acceptance

Interpretation of test results and limitations on imperfections in welds shall comply with the requirements for 100 percent Radiography, per ASME B31.3, Chapter VII, Table K341.3.2A.

3.1.5 Corrections and Repairs

Defects shall be repaired in accordance with approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Whenever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners. After a defect is thought to have been removed, and prior to rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated. After repairs have been made, the repaired area shall be reinspected and shall meet the standards of acceptance for the original weld. Any indication of a defect shall be regarded as a defect unless reevaluation by nondestructive methods and/or by surface conditioning shows that no defect is present.

3.1.5.1 Defect Removal

Defective or unsound weld joints shall be corrected by removing and replacing the entire weld joint, or for the following defects corrections shall be made as follows:

a. Excessive Convexity and Overlap: Reduce by removal of excess metal.

b. Excessive Concavity of Weld, Undersized Welds, Undercutting: Clean and deposit additional weld metal.

c. Excessive Weld Porosity, Inclusions, Lack of Fusion, Incomplete Penetration: Remove defective portions and reweld.

d. Crack in Weld or Base Metal: Remove crack throughout its length, including sound weld metal for a distance of twice the thickness of the base metal or two inches, whichever is less, beyond each end of the crack, followed by the required rewelding. Complete removal shall be confirmed by magnetic particle inspection for carbon steel or liquid penetrant inspection for stainless steel. Inspection procedures shall comply with the requirements of ASME B31.3.

e. Poor Fit-Up: Cut apart improperly fitted parts, and reweld.

3.1.5.2 Methods of Defect Removal

The removal of weld metal or portions of the base metal shall be done preferably by chipping, grinding, sawing, machining, or other mechanical means. Defects also may be removed by thermal cutting techniques. If thermal cutting techniques are used, the cut surfaces shall be cleaned and smoothed by mechanical means. In addition, at least 1/8-inch of metal shall be removed by mechanical means from the cut surfaces of stainless steel.

3.1.5.3 Rewelding

Repair welds shall be made using an electrode or filler wire preferably smaller than that used in making the original weld. Rewelding shall be done using qualified welding procedures. The surface shall be cleaned before rewelding. Repair welds shall meet the requirements of this specification.

3.1.5.4 Peening or Caulking

The use of force (peening) or foreign materials to mask, fill in, seal, or disguise any welding defects shall not be permitted.

3.2 INSTALLATION

3.2.1 Precautions

Special care shall be taken by the Contractor to insure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, water, welding slag, and foreign objects including any purge dam materials and construction debris. The Contractor shall take the following steps to insure these conditions.

a. Coated pipe shall be handled only with canvas or nylon slings or padded clamps. Any coating damaged by improper handling or storage shall be repaired as specified.

b. Pipe brought to the site shall be stored on blocks or horses at least 18 inches above the ground. Padded blocks or horses shall be used for coated pipe. The method and height of storing coated pipe shall be in accordance with the coating manufacturer's instructions.

c. Visual inspection shall be made of the inside of each length of pipe to ensure that it is clear and clean prior to installation.

d. The open ends of the pipe system shall be closed at the end of each day's work or when work is not in progress with an expansion plug and shall not be opened until the work is resumed.

e. A swab, with a leather or canvas belt disc to fit the inside diameter of pipe, shall be pulled through each length of pipe after welding in place.

f. Obstruction remaining in the pipe after completion of the system shall be removed at the expense of the Contractor.

3.2.2 Protective Coatings

3.2.2.1 Application of Tape Wrapping

Surfaces to receive tape shall be clean, dry, grease-free and dust-free. Extruded polyethylene coating and adhesive undercoat surfaces to be tape wrapped shall be primed with a compatible primer prior to application of the tape. The primer shall be as recommended by the tape manufacturer and approved by the extruded polyethylene coating manufacturer. Weld beads shall be wire brushed. Burrs and weld spatter shall be removed. Weld beads shall be covered with one wrap of tape prior to spiral wrapping. Fittings shall be wrapped spirally beginning with one complete wrap three inches back from each edge of the extruded polyethylene coating. For pipe less than four-inch size, one layer half-lapped shall be used. For pipe four-inch size and larger, two layers half-lapped shall be used, with the second layer wrapped opposite hand to the first. On irregular surfaces one layer shall be applied half-lapped and stretched to conform to the surface, followed by a second layer half-lapped and applied with the tension as it comes off the roll.

3.2.2.2 Inspection and Testing

The condition of factory field coated and wrapped piping shall be the responsibility of the Contractor and all damage to the protective covering during transit and handling shall be repaired by the Contractor at no additional cost to the Government. All field coating and wrapping shall be subject to approval by the Contracting Officer. The entire pipe shall be inspected as specified in sub-paragraph "Testing of Protective Coatings" under paragraph "Protective Coatings for Buried Carbon Steel and Stainless Steel Piping." The inspection for holidays shall be performed just prior to lowering the pipe into the ditch and every precaution shall be taken during lowering and backfilling to prevent damage to the protective covering.

3.2.2.3 Damage Repair

Damaged areas of extruded polyethylene coating shall be repaired by tape wrapping as specified in the preceding paragraph for fittings. Residual material from the extruded polyethylene coating shall be pressed into the break or shall be trimmed off; all areas to be taped shall be primed, and the tape shall be applied half-lapped.

3.3 INTERIOR EPOXY COATING

When internally epoxy lined pipe is cut, the lining shall be ground back

from the end a minimum of one inch but not more than one and one-half inches.

3.4 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.5 CLEANING OF PIPING

The Contractor shall keep the interior and ends of all new piping affected by the Contractor's operations thoroughly cleaned of foreign matter and water before and after being installed. Piping systems shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water or other foreign substance will enter the pipes or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding. It shall be the Contractor's responsibility for insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.6 TRENCHING AND BACKFILLING

Trenching and backfilling shall conform to Section [02302 EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES] [02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS], and the following bedding and backfill requirements. The pipe shall be laid in a bed of sand six inches deep, compacted to the elevation of the bottom of the pipe. The full length of each section of pipe without any protective covering shall be excavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, shall be taken up and relaid. Pipe shall not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill shall be placed and compacted around the pipe or protective coating. The remainder of the backfill shall be the same as for other types of pipe.

3.7 INSTALLATION OF UNDERGROUND PIPE

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NOTE: For laterals, the slope shall be at least 0.5% and distance from loop to hydrant pit shall be less than 100 feet.

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Underground fuel pipelines shall be pitched as shown on the drawings. Where not indicated they shall be pitched a minimum of 2 inches per 100 feet. Branch lines to the hydrant pits shall slope up to the pit and if not indicated shall be pitched a minimum of 6 inches per 100 ft. Two-inch pipe size valved drain connections shall be provided at all low points and 1 1/2-inch pipe size valved outlet vent connections shall be provided at all high points. Vent and drain lines shall terminate in male cam-type locking end dry breaks with matching female dust covers and installed in pits. The pipe shall have cover as shown on the drawings. Drain lines shall be installed at the slopes indicated.

3.7.1 Pipe Assembly

Pipe shall be strung parallel and adjacent to or above a trench. The pipe shall be supported on padded skids during welding and inspection of joints. Protective coating shall be inspected and repaired prior to lowering the pipe into the trench. The pipe shall be lowered using only canvas or nylon slings. The sling shall be dug from underneath the pipe after placements and shall not be pulled from underneath the pipe while in contact with it. Care shall be taken to prevent damage to the pipe, welded joints or coating and any such damage shall be repaired as directed by the Contracting Officer. Pressure testing of the pipe shall be done after it has been placed in final position in the trench.

3.7.2 Warning Tapes in Earth Trenches

For the purpose of early warning and identification of buried pipes outside of building walls during future trenching or other excavation, continuous identification tapes shall be provided in the trench. Tape shall be nonmagnetic plastic tape or aluminum foil plastic backed tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape shall be at least three inches in width. Color of tape shall be as standard with the manufacturer with respect to the type of utility buried below the tape. Tape shall have lettering at least one inch high with not less than the following identification on the tape: BURIED JET FUEL PIPING BELOW. Tape shall be installed in accordance with the printed recommendations of the tape manufacturer, as modified herein. Tapes shall be buried at a depth of six inches from the top of the subgrade.

3.7.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures. Where pipes cross other pipes or structures with a separation of less than six inches, install an insulating separator. Protect the pipe from contact with a 12-inch square by 1 inch thick bituminous-impregnated canefiber board.

3.7.4 Protective Coating

When the protective coating on pipe is damaged, the Contracting Officer shall be notified and shall inspect the pipe before the coating is patched. If the damage to the pipe is deeper than 0.050-inch, the damage shall be repaired by welding in accordance with paragraph "WELDING". If the pipe is dented, out of round or damaged to the point that welding will not make it good as new, the length of pipe shall be rejected.

3.8 PIPING LAYOUT REQUIREMENTS

3.8.1 Pipe Fabrication

Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system.

3.8.2 Interferences and Measurements

Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and

arrangements. Verify measurements before commencing work. Submit discrepancies for clarification before proceeding with the installations to the Contracting Officer.

3.8.3 Space and Access

Keep piping, control tubing, which is not detailed close to structures and columns so as to take up a minimum amount of space. Ensure that access is provided for maintenance of equipment, valves and gauges.

3.8.4 Location

Do not place unions in locations that will be inaccessible after the completion of the work. Place unions on each side of equipment.

3.8.5 Piping and Equipment

Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and supports near each change of direction. Select support components which do not restrict the movement of the pipe due to thermal expansion. Space hangers uniformly and arrange symmetrically.

3.8.6 Structural Support

Provide supplementary or intermediate steel or other structural members as required for transmission of loads to members forming part of the supporting structure.

3.8.7 Grade

Where profiles of piping lines are shown on the drawings, grade the line uniformly between changes in slope or direction. Maintain gradient to within $\pm$ 1/4-inch over the entire length of pipe. When backfilling has been completed to the top of the pipe, the pipe shall be surveyed at each joint, logged by station number, and submitted to the Contracting Officer and approved before backfilling can continue.

3.8.8 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100 percent radiographic inspection may be used. Do not use weldolets unless specifically called out (labeled) on the drawings.

3.8.9 Direction Changes

Make changes in the horizontal direction of pipes with long radius fittings. Provide special fittings when required. Do not make miter welds. Make odd-angle offsets with pipe bends or elbows cut to the proper angle.

3.9 TESTING

Piping shall be tested by pneumatic and hydrostatic pressure. Testing shall comply with applicable requirements of ASME B31.3, NFPA 30 and the requirements specified herein. Hydrostatic testing shall be performed using fuel as the liquid. Water shall not be introduced into the system

for testing. Pressure and hydrostatic testing shall be performed only after welding inspection has been completed.

3.9.1 General

Piping to be installed underground shall not receive field applied protective covering at the joints or be covered by backfill until the piping has passed the pneumatic test described herein. To facilitate the tests, the Contractor shall isolate various sections of the piping system and test each one separately. Where such sections terminate at flanged valve points, the line shall be closed by means of blind flanges in lieu of relying on the valve. The Contractor shall furnish tapped flanges that can be attached to the end of the section of line being tested, and that will permit a direct connection between the piping and the air compressor and/or pressurizing pump. No taps in the permanent line will be permitted. The Contractor shall furnish all necessary equipment for testing; all gauges shall be subject to testing and approval of the Contracting Officer. The air used for pneumatic testing shall have a residual humidity of not over 20 percent. The Contractor shall provide dehumidifying equipment on the suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump shall not exceed 10 cfm.

3.9.1.1 Pneumatic Test Procedure

Special safety measures, including the wearing of face mask, shall be taken during testing under pressure. Only authorized personnel shall be permitted in the area during testing. The pneumatic test pressure shall be applied in increments. A preliminary 25 psig test shall be applied. Examine joints with soap solution. Leaks revealed by this test shall be repaired. The full test pressure shall then be applied. Unless otherwise directed by the Contracting Officer, all piping shall be tested at a pressure of [50] [100] psig for not less than 2 hours, during which time there shall be no drop in pressure, only pressure rises with temperature. The pressure source shall be disconnected during the final test period. Any leaks revealed by the test shall be repaired and the test repeated.

3.9.1.2 Hydrostatic Test Procedure

Upon completion of pneumatic testing and after backfilling, hydrostatically test each piping system with fuel at [275][___] psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. The Contractor shall furnish electricity, instruments, connecting devices, and personnel for test. Fuel shall be furnished by the Government. Defects in work provided by the Contractor shall be corrected by him at his own expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

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NOTE: IF THE COMMAND FUELS FACILITY ENGINEER DIRECTS THE DESIGNER TO HYDROSTATICALLY TEST THE SYSTEM TO 1.5 TIMES THE DESIGN PRESSURE, EXCEEDING THE FLANGE RATING, THE DESIGNER SHALL BE REQUIRED TO WRITE THE COMMISSIONING HYDROSTATIC TESTING PROCEDURES; REMOVING ALL BALL VALVES, CONTROL VALVES, AND INSTRUCTING THE TESTING PEOPLE WHAT VALVES TO CLOSE, WHERE TO CONNECT THE HYDROSTATIC TEST PUMP, BLIND FLANGE PLACEMENTS, AND OTHER SAFETY REQUIREMENTS.

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3.9.2 Performance Testing

The completed fuel system shall be cleaned and performance tested as specified in Section 15899 SYSTEM START UP, FUELING SYSTEM. All control valves, both manual and automatic, shall be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

-- End of Section --