UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2012
****

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 52 43.13

AVIATION FUEL PIPING

02/10

-- End of Section Table of Contents --

SECTION 33 52 43.13

AVIATION FUEL PIPING
02/10

****
NOTE: This guide specification covers the requirements for piping and valves for aircraft refueling systems constructed to the requirements of the DoD Type III/IV/V, and Cut'n Cover Hydrant Refueling System Standards.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

****
NOTE: DoD Type III systems shall conform to Standard Design 078-24-28 PRESSURIZED HYDRANT FUELING SYSTEM (TYPE III). DoD Type IV/V systems shall conform to Standard Design 078-24-29 AIRCRAFT DIRECT FUELING SYSTEM (TYPE IV) DESIGN.
****

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in

the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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 PETROLEUM INSTITUTE (API)

API RP 1110	(2007) Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide
API RP 582	(2009) Welding Guidelines for the Chemical, Oil, and Gas Industries
API STD 600	(2009; Errata 2009) Steel Gate Valves-Flanged and Butt-welding Ends, Bolted Bonnets
API STD 608	(2008) Metal Ball Valves - Flanged, Threaded, And Welding End
API Spec 5L	(2007; Errata 2009; Addenda 1 2009; Addenda 2 2010; Addendum 2 2011; Addendum 3 2011; 44th Ed) Specification for Line Pipe
API Spec 6D	(2008; Errata 1 2008; Errata 2 2008; Errata 3 2009; Addendum 1 2009; Errata 4 2010; Errata 5 2010; Errata 6 2011; Addendum 2 2011) Specification for Pipeline Valves
API Spec 6FA	(1999; R 2006; Errata 2006; Errata 2008) Specification for Fire Test for Valves
API Std 594	(2010) Check Valves: Flanged, Lug, Wafer and Butt-Welding
API Std 607	(2010) Testing of Valves: Fire Test for Soft-Seated Quarter-Turn Valves

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C209	(2006) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipelines
AWWA C215	(2010) Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0M/A3.0	(2010) Standard Welding Terms and Definitions
AWS A5.1/A5.1M	(2004) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.5/A5.5M	(2006) Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
AWS A5.9/A5.9M	(2012) Specification for Bare Stainless Steel Welding Electrodes and Rods
AWS Z49.1	(2005) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME B1.1	(2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B31.1	(2012) Power Piping
ASME B31.3	(2010) Process Piping
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing

	Qualifications
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011a) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A182/A182M	(2012a) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2012a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2012) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A234/A234M	(2011a) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A269	(2010) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312/A312M	(2012) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A358/A358M	(2008a) Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications
ASTM A403/A403M	(2012) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A961/A961M	(2012) Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications
ASTM D229	(2009b) Rigid Sheet and Plate Materials Used for Electrical Insulation

ASTM E94 (2004; R 2010) Radiographic Examination

ASTM F436 (2011) Hardened Steel Washers

BRITISH STANDARDS INSTITUTE (BSI)

BS EN ISO 10497 (2010) Testing of Valves Fire Type-Testing Requirements

ENERGY INSTITUTE (EI)

EI 1529 (2005; 6th Ed) Aviation Fueling Hose and Hose Assemblies

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

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

MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (2012; Errata 2011; Errata 2011) Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AS5877 (2007; Rev A) Aircraft Pressure Refueling Nozzle

SAE J514 (2012) Hydraulic Tube Fittings

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 5/NACE No. 1 (2007) White Metal Blast Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-25896 (1983; Rev E; Notice 1 1989; Notice 3 2003) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter

MIL-DTL-24441 (2009; Rev D) Paint, Epoxy-Polyamide, General Specification for

MIL-PRF-13789	(1999; Rev E; Notice 1 2008) Strainers, Sediment: Pipeline, Basket Type
MIL-PRF-4556	(1998; Rev F; Am 1 1999; Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSEA T9074-AS-GIB-010/271	(1999; Notice 1) Requirements for Nondestructive Testing Methods

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions shall be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Submit a copy of welding qualified procedures, where the procedures will be used, and a list of names and identification symbols of qualified welders and welding operators. Submit Operation and Maintenance Manuals for the equipment items or systems listed below. Refer to Section 01 78 23.33OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various type of equipment and systems.

Manual Valves
Flexible Ball Joints
Surge Suppressor Tank and Valve
Strainers
Protective Coatings
Sample Connections
Isolating Gasket Kits
Gaskets
Flexible Hoses

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G"

designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fittings[; G][; G, [_____]]
Surge Suppressor Tank and Valve[; G][; G, [_____]]
Flexible Ball Joints[; G][; G, [_____]]
Strainers[; G][; G, [_____]]
Flexible Hoses[; G][; G, [_____]]
Lightning Surge Arrester[; G][; G, [_____]]
Epoxy Lining[; G][; G, [_____]]
Protective Coatings[; G][; G, [_____]]
Sample Connections[; G][; G, [_____]]
Isolating Gasket Kits[; G][; G, [_____]]
Gaskets[; G][; G, [_____]].
Purge Blocks[; G][; G, [_____]]
Pigging Accessories[; G][; G, [_____]]

SD-06 Test Reports

Pneumatic Test
Hydrostatic Test
Geometry Tool Reports[; G][; G, [_____]]

SD-07 Certificates

Welding
Welding qualified Procedures[; G][; G, [_____]]
Qualifications of Welding Inspectors
Qualifications of Welders
Fittings
Surge Suppressor Tank and Valve[; G][; G, [_____]]
Isolating Gasket Kits
Survey final elevations
Pipeline Pigging Verification[; G][; G, [_____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G][; G, [_____]]

1.4 QUALITY ASSURANCE

****
NOTE: Specify as directed by the COMMAND FUELS FACILITY Engineer.
****

1.4.1 Welding Qualifications

[Welding of fuel pipe joints shall comply with Section 33 52 90.00 20 WELDING FOR POL SERVICE PIPING.] [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 BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators 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 practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.]

[1.4.2 Qualifications of Welders

Welders and welding procedures shall be qualified in accordance with requirements of ASME B31.3. Submit for each pipe material and process a Welding Procedure Specification (WPS), its corresponding Procedure Qualification Record (PQR), and the welder Performance Qualification (WPQ) for each welder and each specification. Submit on the forms contained within Appendix A of ASME BPVC SEC IX. All welding is to be performed in accordance with applicable requirements of API RP 582 and AWS WHB-2.9, Chapter 5 as it applies to stainless steel piping.

1.4.2.1 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.

1.4.2.2 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.

]PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

****
NOTE: Per COMMAND FUELS FACILITY Engineer.
****

Pipe and fittings in contact with fuel shall be stainless steel, interior epoxy coated carbon steel, or 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 an exterior protective coating and shall be cathodically protected in accordance with Section [26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT] [26 42 17.00 10 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.

2.1.1 Carbon Steel Piping

Subject each length of pipe to factory hydrostatic testing and ultrasonic testing in accordance with their respective pipe specification.

a. Piping 305 mm 12-Inches and Larger: Seamless, ASTM A53/A53M Grade B having a wall thickness of 9 mm 0.375-inch.

b. Piping 62 through 250 mm 2 1/2 through 10-Inches: Seamless, Schedule 40 API Spec 5L Grade B or ASTM A53/A53M Grade B.

c. Piping 50 mm 2-Inches and Smaller: Seamless, Schedule 80 API Spec 5L Grade B or ASTM A53/A53M Grade B.

d. Welding Electrodes (Factory Fabrication): E70XX low hydrogen electrodes conforming to AWS A5.1/A5.1M or AWS A5.5/A5.5M.[Provide pipe with coating system Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.] [Interior epoxy coating system shall be factory applied and in accordance with MIL-PRF-4556, 0.15 to 0.2 mm 6 to 8 mils dry film thickness. Documentation of conditions during application shall be submitted to the Contracting Officer.]

2.1.1.1 Interior Epoxy Coated Carbon Steel Piping

****
NOTE: Pipe smaller than 75 mm (3-Inches) can not be Coated. Per COMMAND FUELS FACILITY Engineer.
****

Before applying the epoxy coating, the inside of the pipe shall be sandblasted to "white" metal conforming with SSPC SP 5/NACE No. 1. 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 25 mm one inch but not more than 37 mm 1-1/2 inches.

2.1.1.2 Coat Testing

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 Contracting Officer. The shop shall notify the Contracting Officer at least one week before the pipe and fittings will be cleaned and epoxy coated. 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. Pipe 62 mm 2-1/2-inches and smaller shall not be interior coated.

2.1.2 Stainless Steel Piping

****
NOTE: A cyclic fatigue analysis need not be made by

the designer to determine wall thickness of welded pipe as long as the pipe meets the sizes listed in TABLE A. The minimum wall thickness that welded pipe can be is the Schedule 20 listed in TABLE A. Pressures found in the surge analysis will be used.

****

a. Piping 62 mm 2-1/2-Inches and Larger:

(1) ASTM A358/A358M, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A312/A312M 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/A358M with the deviation from the nominal wall thickness less than 0.25 mm 0.01-inch. ASTM A312/A312M 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 BPVC SEC VIII D1. One hundred spots may be reinspected at the project site prior to installation and backfilling at the request of the Contracting Officer. 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 at no additional cost to the government. Observation by the Contracting Officer 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. 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 K341.3.2 of Chapter IX 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 Officer and shall indicate the pipe mark and installed location of each piping section on the project site. Observation by the Contracting Officer 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) Qualifications of Welding Inspectors for Stainless Steel Piping: 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 use the methods as defined in Table K341.3.2 of the ASME B31.3.

(7) 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) Submit Quality Assurance Plan for the welding, inspecting and testing of the welded seam pipe.

TABLE A

Nominal Pipe Size	Nominal (Average) Pile O.D.	Wall Thickness(tn)
405 mm16 inches	405 mm16.000 inches	7.8 mm0.312 inch
356 mm14 inches	356 mm14.000 inches	7.8 mm0.312 inch
305 mm12 inches	322 mm12.750 inches	6.2 mm (0.250 in
254 mm10 inches	273 mm10.750 inches	6.2 mm0.250 inch
203 mm8 inches	218 mm8.625 inches	6.2 mm0.250 inch
152 mm6 inches	167 mm6.625 inches	5.5 mm0.219 inch
100 mm4 inches	114 mm4.500 inches	5.5 mm0.219 inch
64 mm2.5 inches	72 mm2.875 inches	3.9 mm0.156 inch

b. Piping 50 mm 2-inches and Smaller: Schedule 80 ASTM A312/A312M seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A312/A312M 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 13 mm 1/2-inch tubing to be 1.2 mm 0.049-inch.

d. Welding Electrodes (Factory Fabrication): E308L conforming to AWS A5.9/A5.9M.

2.1.3 Protective Coatings for Aboveground Piping

****

NOTE: Per COMMAND SERVICE HEADQUARTERS Engineer for marine environment. Pipe cleaning for severe or marine environment for length of line; pipe mostly abovegrade and long lengths should consider using Section 09 97 13.27. pipe cleaning per SSPC SP

6/NACE No.3 will give good surface cleaning but will not get rust or paint from the bottom of the pits.

****

Provide coating of aboveground piping, piping in pits, pipe supports, filter separators, and miscellaneous metal and equipment in accordance with [MIL-DTL-24441, Type III, and the instructions that follow] [Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES] [Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM]. Color of finish coat shall be [white] [beige]. 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.] [Surfaces shall be blast cleaned according to SSPC SP 5/NACE No. 1.] [Surfaces shall be blast cleaned according to SSPC SP 6/NACE No.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.]

[2.1.3.1 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 (MIL-DTL-24441) consists of individual formulations, for example, Formula 150 is for green primer, and Formula 152 is for white topcoat.

2.1.3.2 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 20 L 5 gal at 21-27 degrees C 70-80 degrees F. Discard any mixed paint remaining at the end of the day.

****

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

****

a. Mixing Ratio. The mixing ratio of the MIL-DTL-24441 coatings (except Formula 159) are all 1:1 by volume, for example, 20 L 5 gallons of component A to 20 L 5 gallons of component B. The mixing ratio of MIL-DTL-24441 for formula 159 is 1:4 by volume.

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 21-27 degrees C 70

to 80 degrees F may be used without an induction period.

2.1.3.3 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 20 L 5 gal mixture of the MIL-DTL-24441 paints at 21-27 degrees C 70-80 degrees F 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 4-16 degrees C 40 to 60 degrees F a 1 hour induction time shall be used. Volumetric mixing spray equipment with in-line heaters set at 21-27 degrees C 70 to 80 degrees 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.

2.1.3.4 Epoxy-Polyamide Coating Application

Epoxy-polyamide coatings, MIL-DTL-24441, may be applied by brushing or spraying. Three coats shall be applied, primer, intermediate, and top. Each coat shall be a different color.

a. Thinning Application. Ordinarily, MIL-DTL-24441 coatings are not thinned. If necessary, up to one pint of epoxy thinner for each L gal 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 three coats of paint to produce approximately 0.075 3 mils dry film thickness (DFT) each. Application which yields in excess of 0.10 4.0 mils DFT should be avoided to prevent sagging. Final coat shall be polyurethane on exterior paint.

c. Spray Application. MIL-DTL-24441 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.

2.1.3.5 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 21 degrees C 70 degrees F. Pot life is longer at lower temperatures and shorter at temperatures above 21 degrees C 70 degrees F. 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.

]2.1.4 Protective Coatings for Buried Steel Piping

[Provide pipe with coating system Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.] [Provide pipe with AWWA C215 coating system of factory-applied adhesive undercoat and continuously extruded plastic resin coating; minimum thickness of plastic resin shall be 0.9 mm 36 mils for pipe sizes 150 mm 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 75 mm 3 inches. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than 150 mm 6 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 AWWA C209, 0.5 mm 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 AWWA C209, 0.25 mm 10 mils nominal thickness tape overlapped not less than 25 mm 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 mm 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.]

2.1.5 Fittings

2.1.5.1 General

Welding ells, caps, tees, reducers, etc., shall 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 are not acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings shall 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.

2.1.5.2 Carbon Steel Fittings

****
NOTE: Tees with branch lines 50 percent of the main line size or more should have guide bars in piggable systems.
****

a. Fittings 62 mm 2.5 Inches and Larger: Butt weld, conforming to ASTM A234/A234M, 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 Magnetic-Particle Examination. Detectable flaws will not be accepted in the supplementary examinations. Fittings shall be identified to relate them to their respective radiograph. Elbows located between the pig launcher and the receiver, shall have a radius three times the pipe diameter. Tees with branches 150 mm 6-inches and larger, shall have guide bars as detailed on the drawings.

b. Fittings 50 mm 2 Inches and Smaller. Forged (socket welded or if indicated on drawings, threaded), 900 kg 2,000-pound W.O.G., conforming to ASTM A105/A105M, Grade 2 and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground and in pits low point drain pipe and high point vent pipe shall be butt welded.

c. Flanges: 68 kg 150 pound weld neck, forged flanges conforming to ASTM A105/A105M, and ASME B16.5. Flanges to be 2 mm 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 S56, Liquid Penetrant Examination as outlined in ASTM A961/A961M. Detectable flaws will not be accepted.

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

2.1.5.3 Stainless Steel Fittings

a. Fittings 62 mm 2.5 Inches and Larger: Butt weld stainless steel conforming to ASTM A403/A403M, 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. Elbows located between the pig launcher and the receiver, shall have a radius three times the pipe diameter. Tees with branches 150 mm 6-inches and larger, shall have guide bars as detailed on the drawings.

b. Fittings 50 mm 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 900 kg 2,000-pound W.O.G. conforming to ASTM A182/A182M and ASME B16.11. Threaded fittings shall only be used for above grade applications. Underground and in pits low point drain pipe and high point vent pipe shall be butt

welded.

c. Unions. Conforming to ASTM A312/A312M, Grade 304 or 316.

****
NOTE: Check system pressures, as Type 304L stainless steel flanges have a pressure rating of 2 MPa (230 PSIG).
****

d. Flanges. 68 kg 150 pound weld neck, forged Type 304[or 304L] stainless steel flanges conforming to ASTM A182/A182M and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps shall be 135 kg 300-pound. Flanges to be 2mm 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 S56, Liquid Penetrant Examination as outlined in ASTM A961/A961M.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J514.

2.1.5.4 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 0.75 mm 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 3 mm 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 12 mm 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 and used without required 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.

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	Bolt Size
50 mm2 inch	16 mm5/8 inch
62 mm2.5 inch	16 mm5/8 inch
75 mm3 inch	16 mm5/8 inch
100 mm4 inch	16 mm5/8 inch
150 mm6 inch	19 mm 3/4 inch
203 mm8 inch	19 mm3/4 inch
254 mm10 inch	22 mm7/8 inch
305 mm12 inch	22 mm 7/8 inch
355 mm14 inch	25 mm 1 inch
406 mm 16 inch	25 mm 1 inch
Note: Make allowance for the1 mm 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.	

2.1.6 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 three 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/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7 when only carbon steel flanges are involved. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes 25 mm one inch and smaller and Eight-Pitch Thread Series for sizes larger than 25 mm one inch. Nuts shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7 for carbon steel bolts. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes 25 mm one inch and smaller and Eight-Pitch Thread Series for sizes larger than 25 mm one inch. Provide washers under bolt heads and nuts. Washers to be ASTM F436, flat circular stainless steel for stainless steel bolts, and carbon steel for carbon steel bolts. 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.

2.1.7 Gaskets

ASME B16.21, composition ring, using a Buna-N, polytetrafluoroethylene (PTFE), or a protein and glycerin binder, 3 mm0.1250-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.

2.1.8 Relief and Drain System Piping

****
NOTE: Per COMMAND FUELS FACILITY Engineer.
****

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/A53M Grade B Carbon Steel] [ASTM A312/A312M seamless Type 304L Stainless Steel]. See Gaskets specified herein before.

2.1.9 Relief and Drain System Protective Coating

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

2.1.10 Field Applied Protective Coatings

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

2.1.10.1 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 1 mm 40 mil polyolefin backing and 1 mm 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.1.10.2 Tape for Fittings

Fittings and other irregular surfaces shall be tape wrapped. The tape shall be a plastic mastic laminated tape having 0.15 mm 6 mil plastic backing of either polyethylene or polyvinylchloride and 0.72 to 2.4 mm 29 to 44 mil of synthetic elastomer.

2.1.11 Threaded Joints

Threaded joints, if indicated on the drawings, shall be made tight with manufacturer recommended PTFE 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.

2.1.12 Welded Joints

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

2.2 MANUAL VALVES

****
NOTE: Per COMMAND SERVICE HEADQUARTERS Engineer for marine environment, provide stainless steel valves on exterior (aboveground and in pits) piping.
****

All portions of a valve coming in contact with fuel in stainless steel pipe lines or epoxy lined carbon steel pipe lines shall be of noncorrosive

material. Valves in stainless steel pipe lines or epoxy lined carbon 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. Valves in unlined carbon steel pipelines shall have carbon steel body. Stem and trim shall be stainless steel for all valves. Manually operated valves 150 mm 6 inches and larger shall be worm-gear operated and valves smaller than 150 mm 6 inches shall be lever operated or handwheel operated. Valves smaller than 50 mm 2 inches shall have lever-type handles. Valves installed more than 2.4 m 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. Valves in the isolation pits in fuel piping between the pig launchers and the pig receivers shall be full bore, piggable, double block and bleed type. The full bore piggable valves at the launcher and the receiver shall be ball type.

2.2.1 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 50 mm 2 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 50 mm 2 inches shall be ANSI class 150 valves with one piece bodies with flanged ends, unless noted otherwise. The balls in valves 254 mm 10 inches full port and 305 mm 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. Balls shall be solid, not hollow cavity.

2.2.1.1 Materials

Ball shall be stainless steel. Ball valves shall have tetrafluoroethylene (TFE) or fluoroelastetomer (FKM), commonly referred to as Viton seats, body seals and stem seals. Valves 100 mm 4 inches and smaller shall have a locking mechanism.

2.2.1.2 Full Port Ball (DBBV) Valves for Piggable Lines

Ball valves shall be designed, manufactured, and tested to API Spec 6D, fire-safe and tested to API Spec 6FA, API Std 607, and BS EN ISO 10497 (BS 6755, Part 2). Valves shall be trunnion-mounted with independent spring and hydraulically actuated, floating, single piston effect, self-relieving seat rings, with bi-directional sealing. Ball shall be solid type with full through-conduit opening, suitable for passage of pipeline pigs. Stem shall be anti-static, blow-out-proof design with o-ring seals and provided with an emergency sealant injection fitting. Valves shall be 3-piece, bolted body design with raised-faced ANSI Class 150 flanged connections, equipped with body drain/bleed valve and vent fitting, and suitable for double block and bleed service in the closed and open positions. Valves shall be all stainless steel construction, or carbon steel with stainless steel stem, and all wetted parts electroless nickel-plated. Valves shall have nylon or PTFE seat inserts, FKM B body, stem, and seat o-rings, with stainless steel and graphite body gaskets and graphite secondary stem seals. Valves located in vaults or pits shall be equipped with actuator extensions.

2.2.1.3 Electric Valve Actuator

Electric valve actuator shall be as indicated for Plug (Double Block and Bleed) Valves, electric valve actuator.

2.2.2 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 tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower trunnions. 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. Indicator shaft shall be stainless steel. 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. Full port plug valves in distribution piping shall be provided with a 25 mm 1-inch flanged body drain.

2.2.2.1 General

Valves in the operating tank suction and fill lines and the valves at the four valve manifold in the pump room in the tank fill 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 or four single pole, double throw contracts, two for open, two for closed, and shall be watertight and U.L. listed for Class I, Division 1, Group D hazardous areas.

2.2.2.2 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 or vaults shall be provided with handwheel extensions.

2.2.2.3 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 175 kPa 25 psi differential pressure and shall discharge to the throat of, and to the upstream side, of the plug valve.

2.2.2.4 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.

2.2.2.5 Electric Valve Actuator

The actuator, controls and accessories shall be the responsibility of the valve-actuator supplier for sizing, assembly, certification, field-testing and any adjustments necessary to operate the valve as specified. The electric valve actuator shall include as an integral unit the electric motor, actuator unit gearing, limit switch gearing, position limit switches, torque switches, drive bushing or stem nut, declutch lever, wiring terminals for power, remote control,indication connections and handwheel. The electrically actuated plug valve shall be set to open and close completely in 30 to 60 seconds against a differential pressure of 2 MPa 275 PSIG. The actuator settings of torque and limit contacts shall be adjustable. The valve actuator shall be suitable for mounting in a vertical or horizontal position and be rated for 30 starts per hour. The valve actuator shall be capable of functioning in an ambient environment temperature ranging from -38 to 70 degrees C -32 to 158 degrees F.

a. The electrical enclosure shall be specifically approved by UL or Factory Mutual for installation in Class I, Division 1, Group D locations.

b. The electric motor shall be specifically designed for valve actuator service and shall be totally enclosed, non-ventilated construction. The motor shall be capable of complete operation at plus or minus 10 percent of specified voltage. Motor insulation shall be a minimum NEMA Class F. The motor shall be a removable subassembly to allow for motor or gear ratio changes as dictated by system operational requirements. The motor shall be equipped with an embedded thermostat to protect against motor overload and also be equipped with space heaters. It shall de-energize when encountering a jammed valve.

c. The reversing starter, control transformer and local controls shall be integral with the valve actuator and suitably housed to prevent breathing or condensation buildup. The electromechanical starter shall be suitable for 30 starts per hour. The windings shall have short circuit and overload protection. A transformer, if needed, shall be provided to supply all internal circuits with 24 VDC or 110 VAC may be used for remote controls.

d. The actuator gearing shall be totally enclosed in an oil-filled or grease-filled gearcase. Standard gear oil or grease shall be used to lubricate the gearcase.

e. The actuator shall integrally contain local controls for Open, Close and Stop and a local/remote three position selector switch: Local Control Only, Off, and Remote Control plus Local Stop Only. A metallic handwheel shall be provided for emergency operation. The handwheel drive must be mechanically independent of the motor drive. The remote control capability shall be to open and close. Rim pull to operate valve manually shall not exceed 28 kg 80 pounds.

f. Position limit switches shall be functional regardless of main power failure or manual operation. Four contacts shall be provided with each selectable as normally open or normally closed. The contacts shall be rated at 5A, 120 VAC, 30 VDC.

g. Each valve actuator shall be connected to a PLC supplied by "others".

h. The actuator shall have a local display of position even when power has been lost.

i. The actuator shall be supplied with a start-up kit comprising installation instruction, electrical wiring diagram and spare cover screws and seals.

j. The actuator must be performance tested and a test certificate shall be supplied at no extra charge. The test should simulate a typical valve load with current, voltage, and speed measured.

2.2.3 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 conform to API STD 600 and be swing type with material as previously indicated herein. 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.

2.2.4 Silent Check Valves

Spring assisted, wafer/lug pattern, butterfly check with FKM or PTFE seat ring, designed to prevent flow reversal slamming of valve, dual plate, and shall conform to ASME B16.34, API Std 594, except face to face dimensions may deviate from standard. Valves shall be suitable for installation in any orientation. Valve body and trim material shall be as previously indicated herein.

2.3 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 BPVC SEC VIII D1. Valve stems shall be fully guided between the closed and fully opened positions. The valves shall be factory-set to open at 1.8 MPa 265 psi unless otherwise indicated on the drawings. Operating pressure shall be adjustable by means of an enclosed adjusting screw. The valves shall have a minimum capacity of 1.3 L/s 20 GPM at 10 percent overpressure. Valves shall have a replaceable seat. Relief valves that do not relieve to a zone of atmospheric pressure or tank must be a balanced type relief or regulator valve.

2.3.1 Valve Materials

Valves shall have carbon steel bodies and bonnets with stainless steel springs and trim. Valves shall be Class 150 flanged end connections.

2.3.2 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.

2.4 PIPING ACCESSORIES

2.4.1 Flexible Ball Joints

Flexible ball joints shall be [stainless steel] [carbon steel with electroless nickel-plating to a minimum of 0.075 mm 3 mils thickness], 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 135 degrees C 275 degrees F. Joints shall be designed for minimum working pressure of ANSI Class 150. Injectable packing will not be allowed.

2.4.2 Pipe Sleeves

Pipe sleeves shall be installed where indicated and 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 13 mm 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.

2.4.3 Strainers

2.4.3.1 Basket Type

Strainer shall be in compliance with MIL-PRF-13789, except as specified otherwise. Strainer end connections shall be designed in accordance with ASME B16.5, Class 150. Strainer body material shall be the same as the material specified for manual valves. 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 20 kPa 3 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. The strainer shall be equipped with a direct-reading, piston type differential pressure gauge that measures the differential pressure across the basket. The gauge shall consist of a spring-supported, corrosion resistant piston moving inside a glass cylinder, with high pressure applied on top of the piston and low pressure applied below it. Under a differential pressure of 21 kPa 30 PSI, leakage past the piston shall not exceed 120 drops per minute. The cylinder shall have stainless steel and flanges with FKM O-ring seals. The high pressure inlet of the gauge shall have a 10-micron pleated paper filter and the low pressure connection shall have a fine mesh stainless steel strainer. The gauge shall have an operating pressure of 210 kPa 300 PSI. Differential pressure range of the gauge through approximately 75 mm 3 inches of piston movement shall be 0-21 kPa 0-30 PSI with an accuracy of $\pm$ 0.034 0.5 PSI, calibrated linearly with one kPa PSI scale graduations. High and low pressure connections shall be 6 mm 1/4 inch NPT female with a stainless steel bar stock valve at each connection. Construction of the

gauge shall be such that a 3-valve manifold is not necessary. If only one bar stock valve is closed, the gauge shall not be damaged by up to 210 kPa 300 PSI differential pressure in either direction. A pressure gauge shall be attached to the differential pressure gauge to indicate the high pressure and have a range of 210 kPa 300 psi.

2.4.3.2 Cone Type (Temporary)

Strainer shall be stainless steel type 304 or 316, 100 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe shall be not less than three to one at the pump suction, and 4 mm 5/32-inch perforations and suitable for bi-directional flow at the inlet to the hydrant pit control valves.

2.4.4 Pipe Hangers and Supports

2.4.4.1 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 0.25 mm 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 mm 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 Agency. A PTFE pad shall be installed between the pipe and the u-bolt.

2.4.4.2 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 PTFE insulation strips.

2.4.4.3 Low Friction Supports

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

2.4.4.4 Concrete and Grout

Concrete and grout for anchors and supports shall comply with SECTION 03 30 00.00 10 CAST-IN-PLACE CONCRETE.

2.4.5 Sample Connections

a. Sample connections shall be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection shall include a 6 mm 1/4-inch sampling probe where the probe faces upstream, ball valve and 6 mm 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.

b. Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly shall consist of a 1.8 m 6-foot length of 6 mm 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.

2.4.6 Flanged Swivel Joints

Flanged swivel joints shall be stainless steel, single plane, 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 three years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps. The electrical continuity from one flange to another (without the use of ground straps) shall be less than 1000 ohms. Each swivel joint shall have at least two ball bearings and one roller bearing and two seals.

2.4.7 Monitoring Points

At the following locations, provide 13 mm half-inch pipe, flanged ball valve, and blind flange for future test equipment connections:

a. On the filter separator discharge header in the pumphouse.

b. At the Hydrant Hose 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.

2.4.8 Fuel Hose

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

2.4.9 Pressure Fueling Nozzle

****
NOTE: Specify type of nozzle as directed by the COMMAND FUELS FACILITY Engineer.
****

Nozzles shall conform to SAE AS5877, Type [D-1] [D-2] [D-3]. 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.

2.4.10 Nozzle Adapter (SPR)

Adapter shall be a nominal 62 mm 2-1/2 inches with self-closing valve in accordance with MIL-A-25896. Adapter shall have a 100 mm 4 inch flange mounting and vacuum tight, locking dust cap using the SPR lugs.

2.4.11 Pigging Accessories

2.4.11.1 Closure Door

The closure shall be hinged, swing bolted closure of the same material as the pipe and for a Class 150 system. Gasket shall be nitrile. Eye bolts shall be pinned to lugs on the hub.

2.4.11.2 Signaler

The pig signaler shall be mechanical flag type with manual reset, and be located on the pig launcher and the pig receiver. Material in contact with the fuel shall be stainless steel. Units shall be suitable for removal and installation under line pressure of 275 psig. Signaler shall be capable of withstanding line pressure of a Class 150 system.

2.5 FLEXIBLE HOSES

Flexible hoses for fueling pumps shall have ANSI Class 300 flanges to mate to the pump and Class 150 to connect to the system 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 2 MPa 275 psig. Length and application of flexible hoses shall be per manufacturer's written recommendations.

2.6 AUTOMATIC AIR VENT

Unit shall have 25 mm one-inch connections and automatically vent air under pressure, and prevent a vacuum when pressure drops below a positive pressure. As fuel fills the vent, a float shall rise and form a drip-tight closure. The unit pressure rating shall be a minimum of 2 MPa 275 psi. The float shall be stainless steel. Body and cover be carbon steel or ductile iron and be internally epoxy coated.

2.7 SURGE SUPPRESSOR TANK AND VALVE

The unit shall be fabricated from carbon steel, internally coated pressure vessel with a rubber bladder or a stainless steel diaphragm separating the fuel from the gas charge. The epoxy coating shall be in accordance with MIL-PRF-4556. The rubber bladder shall be molded synthetic nitrile rubber (Buna-N). The unit shall be constructed and labeled in accordance with ASME BPVC SEC VIII D1. The housing shall be designed for a working pressure of 2 MPa 275 PSIG. The gas precharge shall be dry nitrogen and shall have a pressure gauge, gas valve, and an adapter for field charging. Bladder precharge pressure shall be 1 MPa 80 PSIG. The connection to the

piping system shall be Class 150 ANSI flange, size as indicated on the drawings. The connection shall have a check valve to provide unrestricted flow into the vessel and restricted flow from the vessel. The flange shall have a 13 mm 1/2-inch NPT connection with a valve and adapter to relieve fluid pressure during gas recharging and to drain the vessel during removal. A charging assembly shall be provided. The surge control supplier shall furnish a service person trained to provide installation check-out assistance and to supervise operation and testing necessary to place the surge control system into service and to provide training on charging, recharging, and checking the surge suppressor.

PART 3 EXECUTION

****
NOTE: Specify as directed by the COMMAND FUELS FACILITY Engineer.
****

3.1 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 CLEANING OF PIPING

Keep the interior and ends of all new piping, affected by construction 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 insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.3 TRENCHING AND BACKFILLING

Trenching and backfilling shall conform to Section 31 00 00 EARTHWORK, and the following bedding and backfill requirements. The pipe shall be laid in a bed of sand 150 mm 6 inches deep, compacted in accordance with Section 31 00 00 EARTHWORK, paragraph "Backfilling and Compaction". Sand shall meet the requirements of Section 31 00 00 EARTHWORK, paragraph "Select Granular Material". 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 to a depth of 305 mm 1 foot above top of pipe. The remainder of the backfill shall be the same as for other types of pipe.

3.4 PIPING LAYOUT REQUIREMENTS

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 Location

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

3.4.5 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.

3.4.6 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.

3.4.7 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 + 6 mm 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, and logged by station number. Submit to the Contracting Officer for approval the survey final elevations before backfilling can continue.

3.4.8 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 50 mm 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.

3.4.9 Direction Changes

Make changes in 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.

3.5 WELDING

3.5.1 General

All joints, unless indicated otherwise, in carbon steel and stainless steel piping systems shall be welded. [Welding of fuel pipe joints shall comply with Section 33 52 90.00 20 WELDING FOR POL SERVICE PIPING.][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 GMAW or GTAW process.]

****
NOTE: If Section 33 52 90.00 20 WELDING FOR POL SERVICE PIPING is chosen, delete the rest of the paragraph.
****

[a. Definitions shall be in accordance with AWS A3.0M/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 AWS 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. Submit alternate method for approval. Back purge gas shall be used for the root pass and hot pass of all pipe welds. The use of flux-coated or cored welding rod is prohibited in making the root pass.

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

3.5.2 Tests

a. All steel pipe welds, except factory seam welds, including high point vent pipe and low point drain pipe, shall be site examined by radiographic methods to determine conformance to the paragraph "Standards of Acceptance". Socket welds and branch connections which can not be radiographed shall be examined per ASME B31.3, paragraph 341.4.3. All of the socket welds shall be examined, except the socket welds on the non-pressurized drain lines in the [pumphouse] [filter building] to the product recovery tank in which a minimum of 10 percent shall be examined, and 10 percent of the socket welded pipe on the tanks, and to the conformance of the paragraph "Standards of Acceptance".

b. The services of a qualified commercial or testing laboratory approved by the Contracting Officer shall be employed for testing of piping welds. The weld inspector shall have a minimum of two years experience in inspection of stainless steel piping and two years in commercial or military aircraft hydrant fueling systems, petroleum refineries, power generating plants, or chemical process plants. Costs of testing, including retesting or repaired welds, shall be borne by the Contractor.

c. Procedures for radiographic inspection shall be in accordance with NAVSEA T9074-AS-GIB-010/271 or ASTM E94. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectionable defect shall be removed by grinding or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface.

3.5.3 Standards of Acceptance

Interpretation of test results and limitations on imperfections in welds shall comply with the requirements for 100 percent Radiography for the circumferential butt welds, and visual examination for the welds that cannot be radiographed, per ASME B31.3, Chapter IX, Table K341.3.2.

3.5.4 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.

3.5.4.1 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 50 mm 2 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.

3.5.4.2 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 3 mm 1/8-inch of metal shall be removed by mechanical means from the cut surfaces of stainless steel.

3.5.4.3 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.

3.5.4.4 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.

3.6 INSTALLATION

3.6.1 Precautions

Take special care to ensure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, water, weld slag, and foreign objects including construction debris. Take the following steps to ensure 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 458 mm 18 inches above the ground and adequately supported to prevent sagging. 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. Pipe ends shall be protected and capped against weather at all times, except to accommodate immediate installation.

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 by use of expansion plugs 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.

g. Plasma cutters and torches are not to be used to make penetrations in the pipe or to cut pipe.

h. After installation and backfill of the hydrant loop is complete and before fuel is put in the pipe, the pipe will be cleaned using foam swabs and poly coated wire brush pigs and compressed dry gas, residual

humidity of not over 20 percent. Ten flights of a combination of swab and brush pigs shall be run. During this, low point drains and high point vents shall be blown clean.

3.6.2 Protective Coatings

3.6.2.1 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 100 mm 4-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.

3.6.2.2 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 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 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.

3.6.2.3 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.

3.7 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 38 mm 1-1/2 inches.

3.8 INSTALLATION OF UNDERGROUND PIPE

Underground fuel pipelines shall be pitched as shown on the drawings. Where not indicated they shall be pitched a minimum of 50 mm 2 inches per 30.5 m 100 feet. Branch lines to the hydrant pits shall slope up to the pit. 50 mmTwo-inch pipe size valved drain connections shall be provided at all low points and 38 mm 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 connectors 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.

3.8.1 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.

3.8.2 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. Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape shall be at least 75 mm 3 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 25 mm 1 inch high with warning and identification imprinted in bold black letters continuously over the entire tape length 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 150 mm 6 inches from the top of the subgrade or 305 mm 12 inches below the top surface of earth. Provide permanent color and printing, unaffected by moisture or soil.

3.8.3 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 150 mm 6 inches, install an insulating separator. Protect the pipe from contact with a 305 mm 12-inch square by 25 mm 1 inch thick bituminous-impregnated canefiber board.

3.8.4 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 1.2 mm 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.

3.9 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 Pneumatic Test

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, 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. 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. 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. Provide dehumidifying equipment on the suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump shall not exceed 4.7 L/s 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 167 kPa 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 [667] [333] kPa [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

Upon completion of pneumatic testing and after backfilling, hydrostatically test each piping system with fuel at [2] [_____] MPa [275] [_____] psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. Furnish electricity, instruments, connecting devices, and personnel for test. Fuel shall be furnished by the Government. Defects in work shall be corrected at the Contractor's expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

****

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 will 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.
****

3.9.2 Performance Testing

The completed fuel system shall be cleaned and performance tested as specified in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START UP. 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.

3.10 PIPELINE PIGGING VERIFICATION

3.10.1 Geometry Tool Reports

After the system is installed and prior to performance testing, a field/preliminary report shall be issued and a debrief given to Government personnel onsite on the condition of the fuel hydrant loop. This shall be comprised of raw data in the form of a PC download or equivalent which shows a continuous scan of each data unit output. Results of a preliminary interpretation of the data shall be reported. These shall include as a minimum all critical anomalies. A final report shall include a description of the principle of operation, explanation of raw data, presentation of raw data, data to be clearly marked with distance traveled scale with classified anomaly location and all identifiable pipeline features, and all anomalies to be classified with locations in summary tabular form.

3.10.2 Workmanship

Verify pipe bend radii at pipe locations between pig launchers and receivers. If a pipe bend is less than 3D, replace the bend.

3.10.3 Pipeline Internal Inspection Operations

3.10.3.1 General

The following pigs will be propelled through the pipeline with product in order to inspect the pipeline: 1.7 kg 5 pound density foam swab, combination poly scraper-magnetic, stainless steel wire brush, aluminum plate gauge, and geometry tool. Tracking devices shall be used on all pigs. At a minimum, the sequence of pig runs shall be as follows: 1) foam swab for proving and cleaning, 2) wire brush for cleaning, 3) scraper-magnetic for cleaning, 4) aluminum plate gauge for gauging internal anomalies, 5) scraper-magnetic for cleaning, 6) wire brush for cleaning, 7) scraper-magnetic for cleaning, 8) foam swab for cleaning, (Note: the number of pig flights of each type of cleaning pigs shall be determined by the amount and type of debris removed. The conclusion of the cleaning process shall be when debris recovered is only that from the pigs themselves. This determination will be determined by the project's system supplier and the Contracting Officer), 9) geometry tool. The pipe wall shall be continuously monitored on a real-time basis during the geometry pig run. Anomalies such as patches, couplings, or flanges shall also be identified, and the wall thickness given. The geometry pig's technician will determine if additional runs are necessary. A permanent data set of internal inspection survey findings shall be generated.

3.10.3.2 Preparatory Work

The Government will bring to the attention of the Contractor all statutes,

rules and regulations relevant to the performance of the work on the site (on Government property) and will also provide the Contractor with a copy of its own site regulations (if any). Provide the pigging vendors with all-available pipeline records and drawings.

3.10.3.3 Pig Load And Launch

****
NOTE: If pig a launcher and a receiver are not provided in the contract, portable ones will be by the Contractor during pigging operations.
****

The pig shall be loaded into the pig launcher by the Contractor. The method of loading and lodging the front pig cup into the launcher shall not involve the use of uncontrolled mechanical force applied to the rear of the pig.

3.10.3.4 Pipeline Operation During Pigging

All pig runs shall be made with the line packed with product. The system pumps will be used to propel the pig. The new pig traps will be used for pig launch and retrieval.

3.10.3.5 Brush and Gauging Survey

Run a brush pig at least as often as previously indicated. The brush pig shall be designed and provided by the geometry pig vendor. Additional runs may be required based upon the amount of debris found in the pipeline. The onsite geometry pig vendor's personnel shall determine if additional runs are required. Immediately following the brush pig run and immediately prior to the geometry survey, run, as a minimum, a single batching pig fitted with a gauge plate equal to 90 percent of the pipeline normal inside diameter. The plate is to be a segmented aluminum disk of 3 mm 1/8 inch thickness. The plate gauge pig shall also include a tracker and tracking equipment. Track the pig assembly above ground during the operation.

3.10.3.6 Geometry Survey

After a satisfactory gauging pig run, the pipeline geometric defects shall be determined by a geometry tool. The geometry tool shall provide accuracy geometric anomaly detection, and bend radius measuring capability. The data obtained shall be presented in a PC software format to allow user friendly analysis and presentation. The geometry tool assembly shall be capable of:

a. Operating in hydrocarbon liquid environment, specifically jet fuel, at a pressure of up to ANSI 300 rating.

b. Traversing the pipeline with nominal wall thickness and possible bore restrictions down to 90 percent of nominal pipe inside diameter.

c. Traversing the pipeline length at a speed of between 60 and 100 m/min 3 and 5 ft/sec when propelled by pumped jet fuel. Pressure differential across pig not to exceed 34 kPa 50 psi.

d. Traversing through smooth pipe bends as small as 3D (3 pipe diameters) radius and single miter bends of up to 10 degrees change of direction.

e. Include a tracker and tracking equipment. Track the pig assembly above ground during the operation. The battery life of the tracker shall not be less than 72 hours.

f. Manual loading into the new horizontal pig trap.

The geometry tool assembly instrumentation performance shall be capable of:

a. Battery life to be minimum 18 hours at operating conditions.

b. Principle of operation to be electronically stored geometry system.

c. Geometry sensing to span full circumference and length of pipe, with associated distance measuring method.

d. Geometry system shall be capable of:

(1) positive location and identification of each geometric anomaly.

(2) positive location and identification of each bend.

(3) positive location and identification of distance marker reference points of either magnetic or electronic type placed on or above the pipe.

e. Classification of geometric anomalies to be as minimum:

(1) discrimination between ovality and intrusion anomalies.

(2) mechanical damage such as mill defects, dents, internal gouges, and buckles.

(3) pipeline weld defects (such as excess weld penetration).

(4) geometric thickness anomalies. As a minimum, these shall be reported in the following categories within the listed accuracy.

(aa) magnitude of anomaly (+/- 25 mm1 inch)
(bb) span of anomaly (+/- 25 mm1 inch)
(cc) ovality (+/- 2.5 mm0.1 inch)
(dd) span of ovality (+/- 25 mm1 inch)
(ee) anomaly station (+/- 1:2,000)

3.10.3.7 Pipe Wall Thickness Survey

After a satisfactory cleaning, gauging, and geometry pig run, the pipeline wall thicknesses shall be determined using an ultrasonic testing tool. The tool shall provide accuracy measurement of pipe wall thickness (+/- 0.25 mm 0.01 inch). The data obtained shall be presented in a PC software format to allow user friendly analysis and presentation.

3.10.3.8 Lost Pig

The Contractor is responsible for a lost pig, finding the pig, retrieval of the pig, and all repairs, radiographs to the pipeline system and the pig.

-- End of Section --