
USACE / NAVFAC / AFCEA / NASA UFGS-33 52 43.00 20 (November 2009)

Preparing Activity: NAVFAC Superseding
 UFGS-33 52 43.00 20 (April 2006)
 UFGS-15194N (February 2003)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2010

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SECTION 33 52 43.00 20

AVIATION FUEL DISTRIBUTION AND DISPENSING 11/09

NOTE: This guide specification covers the requirements for exterior aviation fuel distribution systems, including aboveground piping, buried piping, piping in manholes, dispensing hardware and related work.

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 and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of Technical Proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

NOTE: This guide specification also covers piping up to and including pumping equipment and valves within each building. System design must conform to UFC 3-460-01 Petroleum Fuel Facilities. Questions concerning system design, consult Engineering Field Division, Naval Facilities Engineering Command, Mechanical Engineering and Design Branch. Questions concerning interpretation of UFC 3-460-01 or this guide specification, consult Naval Facilities Engineering Command, Code OCE3 Petroleum Fuels/Energy Consultant. This specification is being released as an interim measure and will be superseded in the near future.

NOTE: The following information shall be shown on the project drawings:

1. Configuration, slope, sizes, and piping materials for each piping system;
2. Locations, sizes, and type of each valve;
3. Details of manholes (pits) and piping within manholes and aboveground;
4. Capacity and efficiency of each item of equipment;
5. Scale ranges for pressure gages;
6. Whether piping is run aboveground on pedestals or poles, on piers, under piers, in trenches on piers, or in manholes;
7. Details of expansion joints and expansion loops for aboveground piping;
8. Locations of piping, components, and systems which must be constructed of stainless steels or aluminum alloys; and
9. Complete details of cathodic protection systems for buried metallic piping.

PART 1 GENERAL

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 within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API BULL 2209	(1978) Pipe Plugging Practices
API RP 1110	(2007) Pressure Testing of Liquid Petroleum Pipelines
API RP 2003	(2008) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API Spec 5L	(2007; Errata 2009) Specification for Line Pipe
API Spec 6D	(2008; Errata 2008; Errata 2008; Errata 2009; Addendum 2009) Specification for Pipeline Valves
API Spec 6FA	(1999; R 2006; Errata 2006; Errata 2008) Specification for Fire Test for Valves
API Std 1529	(2005) Aviation Fueling Hose and Hose Assemblies
API Std 594	(2004) Check Valves: Wafer, Wafer-Lug and Double-Flanged Type
API Std 607	(2005; Errata 2008) Fire Test for Soft-Seated Quarter-Turn Valves
API Std 609	(2009) Butterfly Valves: Double Flanged, Lug-and-Wafer Type

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.10/A5.10M	(1999; R 2007) Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
AWS A5.4/A5.4M	(2006) Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS A5.5/A5.5M	(2006) Low-Alloy Steel Electrodes for Shielded Metal Arc Welding

ASME INTERNATIONAL (ASME)

ASME B16.11	(2009) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2005) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3	(2006) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.5	(2009) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2007; Addenda 2008; Addenda 2009) Power Piping
ASME B31.3	(2008) Process Piping
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2009) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A 182/A 182M	(2009a) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 193/A 193M	(2009) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2009) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A 234/A 234M	(2007) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 276	(2008a) Standard Specification for Stainless Steel Bars and Shapes
ASTM A 312/A 312M	(2009) Standard Specification for Seamless, Welded, and Heavily Worked Austenitic Stainless Steel Pipes
ASTM A 351/A 351M	(2006) Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts

ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 403/A 403M	(2009) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 53/A 53M	(2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 564/A 564M	(2004; R 2009) Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM B 241/B 241M	(2002) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 247	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B 247M	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings (Metric)
ASTM B 345/B 345M	(2002) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube for Gas and Oil Transmission and Distribution Piping Systems
ASTM D 229	(2009b) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM F 436	(2009) Hardened Steel Washers
ASTM F 436M	(2009) Hardened Steel Washers (Metric)

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

MSS SP-58	(2009) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application

NACE INTERNATIONAL (NACE)

NACE RP0190	(1995) External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems
NACE RP0274	(2004) High Voltage Electrical Inspection of Pipeline Coatings

NACE SP0169 (2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NACE SP0185 (2007) Extruded, Polyolefin Resin Coating Systems with Soft Adhesives for Underground or Submerged Pipe

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (2007; Errata 2008) Flammable and Combustible Liquids Code

NFPA 407 (2007; Errata 2007; AMD 1 2007; AMD 2 2008; AMD 3 2009) Standard for Aircraft Fuel Servicing

NFPA 70 (2008; AMD 1 2008) National Electrical Code - 2008 Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1650 (20080) Seismic Restraint Manual Guidelines for Mechanical Systems - Second Edition

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

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

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-38219 (Rev D) Turbine Fuel, Low Volatility, JP-7

MIL-DTL-5624 (Rev U; Notice 1) Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-F-27630 (Rev D; Am 2; CANC Notice 1) Filter-Separator, Liquid Fuel FFU-2/E

MIL-F-83402 (CANC Notice 1) Filter-Separator, Liquid Fuel FFU-25/E

MIL-P-52327 (Rev C; CANC Notice 1) Pumps, Centrifugal, Electric-Motor-Driven, Positive Prime, Petroleum Products, Airfield Defueling and Receiving

MIL-PRF-52308 (Rev J; Am 1; Am 2) Filter-Coalescer Element, Fluid Pressure

MIL-PRF-81380 (Rev E; Notice 1) Filter/Monitor, Contamination, Aviation Fuel Dispensing System

MIL-V-12003 (Rev F; Am 1; CANC Notice 1) Valves, Plug, Cast-Iron or Steel, Manually

Operated

MIL-V-24624

(Am 1) Valve, Butterfly, Wafer and Lug
Style, Shipboard Service

MS 29514

(Rev C; Notice 1; Notice 2) Flange,
Adapter Locking, Pressure Fuel Servicing
(ASG)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-59248

Meter, Volumetric, Positive Displacement,
Liquid, Aircraft Fuel, 600 GPM

1.2 DEFINITIONS

In ASME B31.3 and NFPA 30 publications, the advisory provisions shall be considered mandatory, as though the work "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" and "owner" shall be interpreted to mean the Contracting Officer.

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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aviation fuel distribution and dispensing system

SD-03 Product Data

Pipe

Valves

Expansion joints

Filter separator units

Fuel quality monitors

Strainers

Fuel meters

Flow controller

Fuel pumps

Relaxation tanks

Pantograph fueling stations

Fuel sample connectors

Venturi

Protective coatings

Fittings

Submit manufacturer's data including specifications and performance test data. For fuel pumps, include actual diameter of impeller being furnished and manufacturer's certified pump test curves showing the characteristics over the entire operating range.

SD-08 Manufacturer's Instructions

Expansion joints

Filter separator units

Fuel quality monitors

Fuel meters

Flow controller

Fuel pumps

Relaxation tanks

Pantograph fueling stations

Venturi

Protective coatings

SD-10 Operation and Maintenance Data

Fuel pumps, Data Package 3

Filter separator units, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.4 QUALIFICATIONS OF WELDERS

Each welder shall be qualified by test using equipment, procedures and a base metal and electrode or filler wire from the same compatible group number that will be encountered in field welding. Procedures and welders shall be qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code. Welders 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 test shall be performed at the work site if practicable. The Contracting Officer shall be furnished a copy of qualified procedures and a list of names and identification symbols of qualified welders. The welder shall apply his assigned symbol near each weld he makes as a permanent record.

1.5 REGULATORY REQUIREMENTS

Conform to the safety and fire regulations of the Station Fire Department when work is in progress. Obtain a "Hot Work" permit each day before performing welding or burning.

1.6 CONCRETE CONSTRUCTION

Provide as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE, and as modified herein.

1.7 EXCAVATING, BACKFILLING, AND COMPACTING

Provide as specified in Section 31 00 00 EARTHWORK.

[1.8 CATHODIC PROTECTION

**NOTE: The need for cathodic protection should be
evaluated on an individual project basis.**

Provide cathodic protection in accordance with Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT.

]PART 2 PRODUCTS

2.1 SEISMIC RESTRAINT

NOTE: The SMACNA Seismic Restraint Manual referenced in the paragraph below shall be applied to locations subject to significant risk of seismic induced loads. The degree to which this manual is to be used for contract drawings and specifications shall be determined by the designer of record in coordination with the NAVFAC Engineering Field Division's Mechanical Design Branch.

Provide fuel oil system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.3, [and NFPA 70,][NFPA 70 and SMACNA 1650,] as modified and supplemented by the contract specifications and drawings.

2.2 SPECIAL REQUIREMENTS

2.2.1 Detail Drawing

Submit drawings showing aviation fuel distribution and dispensing system including types, sizes, location, and installation details for:

- a. Pipe hangers and supports
- b. Bonding
- c. Filter separator units
- d. Fuel meters
- e. Flow controllers
- f. Fuel pumps
- g. Pantograph fueling stations
- h. Bottom loading stations
- i. Manholes
- j. Cathodic protection system

2.2.2 Metal

Metal contacting the fuel shall be stainless steel or aluminum alloy, except as modified herein. Zinc, zinc-coated steel, zinc-coated cast iron, brass, copper, and copper-bearing alloys contacting the fuel shall not be permitted, except as modified herein. Brass contacting the fuel shall be permitted up to a maximum of 0.5 percent of the total fuel wetted surface area in each system. Aluminum castings containing up to a maximum of 10 percent copper contacting the fuel shall be permitted. Carbon steel containing up to a maximum of one percent copper contacting the fuel shall be permitted in carbon steel piping systems. Brass hose fittings and

couplings will be permitted.

2.2.3 System

Capacity and efficiency of equipment shall not be less than that indicated. System components, including piping, equipment, valves, and accessories shall be suitable for maximum working pressure of ANSI Class 150 1896 kPa (gage) at 38 degrees C 275 psig at 100 degrees F.

2.2.4 Electrical Motors, Controllers, Contractors and Disconnects

Provide explosion proof type conforming to NFPA 70, Class I, Division 1, Group D, except where NFPA 70, Class I, Division 2, Group D is indicated. Provide motors, controllers, contactors, and disconnects with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Division 16, "Electrical." Controllers and contactors shall have a maximum of 120-volt control circuits and shall have auxiliary contacts for use with the controls furnished.

[2.2.5 Aluminum Piping

Maximum 300 mm 12 inch diameter.

]2.3 CARBON STEEL PIPING

NOTE: Indicate on drawings the piping materials permitted for each piping system (i.e., carbon steel piping, stainless steel piping, aluminum piping).

2.3.1 Pipe

ASTM A 53/A 53M, Type E (electric-resistance welded, Grades A or B) or Type S (seamless, Grade A or B), black steel; Weight Class STD (Standard) for pipe sizes larger than 50 mm 2 inches, Weight Class XS (Extra-Strong) for pipe sizes 50 mm 2 inches and smaller.

2.3.2 Line Pipe

API Spec 5L, seamless, submerged-arc weld or gas metal-arc weld; Grade B, black steel, Weight Class STD (Standard) for pipe sizes larger than 50 mm 2 inches, Weight Class XS (Extra-Strong) for pipe sizes 50 mm 2 inches and smaller.

2.4 FITTINGS FOR CARBON STEEL PIPING

2.4.1 Threaded Fittings and Socket Welding Fittings

ASME B16.11. Threaded fittings may conform to ASME B16.3, Class 150.

2.4.2 Buttwelding Fittings and Tapered Reducing Fittings

ASME B16.9, ASTM A 234/A 234M, Type WPB, of the same material and weight as the piping in which fittings are installed. Backing rings shall conform to ASME B31.3 and be compatible with materials being welded.

2.4.3 Flanges

ASME B16.5, Class 150, Raised Face Type, ASTM A 105/A 105M.

2.4.4 Unions

ASME B16.39, Class 150.

2.5 WELDING FOR CARBON STEEL PIPING

2.5.1 Process for Carbon Steel

ASME B31.3, metallic arc process. [Ten percent of welds shall be examined by radiography; if 25 percent of the radiographed welds fail, 100 percent of welds shall be examined by radiography.]

2.5.2 Welding Electrodes

AWS A5.1/A5.1M or AWS A5.5/A5.5M, E70XX low hydrogen electrodes.

2.6 STAINLESS STEEL PIPING

NOTE: Indicate on drawings the piping materials permitted for each piping system (i.e., carbon steel piping, stainless steel piping, aluminum piping).

ASTM A 312/A 312M, Grade 304L, Schedule 10 minimum wall thickness for pipe sizes larger than 50 mm 2 inches; Schedule 40 for pipe sizes 50 mm 2 inches and smaller. The entire length of weld in each longitudinal welded pipe shall be radiographically examined in accordance with ASTM A 312/A 312M, S5 Radiographic Examination.

2.7 FITTINGS FOR STAINLESS STEEL PIPING

2.7.1 Threaded Fittings and Socket Welding Fittings

ASME B16.11, except stainless steel shall conform to ASTM A 182/A 182M, Grade F304L.

2.7.2 Buttwelding Fittings and Tapered Reducing Fittings

ASME B16.9, except stainless steel shall conform to ASTM A 403/A 403M, Class WP, Type 304L, of the same weight as the pipe in which the fittings are installed.

2.7.3 Flanges

ASME B16.5, Class 150, Raised Face Type, except stainless steel shall conform to ASTM A 182/A 182M, Grade F304L.

2.7.4 Unions

ASME B16.39, Class 150, except stainless steel shall conform to ASTM A 312/A 312M, Type 304L.

2.8 WELDING FOR STAINLESS STEEL PIPING

2.8.1 Process for Stainless Steel

ASME B31.3, Gas Tungston Arc Process or Gas Metal Arc Process. [Ten percent of welds shall be examined by radiography; if 25 percent of the radiographed welds fail, 100 percent of welds shall be examined by radiography.]

2.8.2 Welding Electrodes

AWS A5.4/A5.4M, E308L electrodes.

2.9 ALUMINUM PIPING

NOTE: Indicate on drawings the piping materials
permitted for each piping system (i.e., carbon steel
piping, stainless steel piping, aluminum piping).

ASTM B 241/B 241M or ASTM B 345/B 345M, alloy 6061-T6, Schedule 40 for pipe sizes 50 mm 2 inches through 300 mm 12 inches; Schedule 80 for pipe sizes 50 mm 2 inches and smaller.

2.10 FITTINGS FOR ALUMINUM PIPING

Aluminum to aluminum threaded connections shall not be permitted.
Stainless steel and brass male threads to aluminum are acceptable.

2.10.1 Socket Welding Fittings

ASME B16.11, except aluminum shall be alloy 5083-H112, alloy 6061-T6, or alloy 356-T6.

2.10.2 Buttwelding Fittings and Tapered Reducing Fittings

ASME B16.9, except aluminum shall be ASTM B 241/B 241M, alloy 6061-T6, of the same weight as the pipe in which the fittings are installed.

2.10.3 Flanges

ASME B16.5, Class 150, Raised Face Type, except aluminum shall conform to ASTM B 247M ASTM B 247, alloy 6061-T6 or alloy 356-T6.

2.10.4 Unions

ASME B16.39, Class 150, except aluminum alloy shall conform to ASTM B 247M ASTM B 247, alloy 6061-T6 or alloy 356-T6.

2.11 WELDING FOR ALUMINUM PIPING

2.11.1 Process For Aluminum

ASME B31.3, Gas Tungston Arc Process or Gas Metal Arc Process. [Ten percent of welds shall be examined by radiography; if 25 percent of the radiographed welds fail, 100 percent of welds shall be examined by radiography.]

2.11.2 Welding Electrodes

AWS A5.10/A5.10M, ER5356 electrodes.

2.12 GASKETS, BOLTS, NUTS AND WASHERS

2.12.1 Gaskets

ASME B16.21, composition ring 1.60 mm 0.0625 inch thick, of one piece factory cut, resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.

2.12.2 Bolts

ASTM A 193/A 193M, Grade B8. Extend no less than two full threads beyond the nut with the bolts tightened to the required torque.

2.12.3 Nuts

ASTM A 194/A 194M, Grade 8.

2.12.4 Washers

ASTM F 436MASTM F 436, flat circular stainless steel washers. Provide washers under bolt heads and nuts.

2.12.5 Electrically Isolating (Insulating) Gaskets for Flanges

NOTE: Indicate locations of each electrically isolating connection.

Provide ASTM D 229 electrical insulating material of 1000 ohms minimum resistance. Material shall be resistant to the effects of aviation hydrocarbon fuels. Provide full face insulating gaskets between flanges. Provide full surface 0.76 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 3.20 mm 0.125 inch thick high-strength phenolic insulating washers next to flanges and flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 13 mm 0.5 inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts.

2.12.6 Electrically Isolating Unions

NOTE: Indicate locations of each electrically isolating connection.

Provide with same electrical insulating materials as specified for electrically isolating flanges.

2.13 VALVES

Steel body except stainless steel shall be Type 304L or Type 316, and

aluminum alloys shall be 3003, 6061-T6, or 356-T6, except as modified in paragraph entitled "Special Requirements," in this section, suitable for working pressure of ANSI Class 150 1896 kPa (gage) at 38 degrees C 275 psig at 100 degrees F, with weatherproof housing designed to exclude driving rain and snow for worm-gear operators. Flanged end connections, except as modified herein. Nonaluminum sizes smaller than 50 mm 2 inches and aluminum sizes smaller than 25 mm one inch may have union end connections, or threaded end connections with a union on all but one side of the valve. Viton or Teflon with metal backup seals. [Provide shut-off valves in tank fill piping and tank suction piping with factory-installed limit switches that are actuated by the valve operators. When valves are closed, limit switches shall prevent operation of the refueling pumps and shall energize red indicating lights in the control panels.]

2.13.1 Gate Valves

NOTE: Do not use the sentence in brackets unless
there are two sources of supply for each valve size
in project.

API Spec 6D, ANSI Class 150. [Conform to fire test requirements of API Spec 6FA.] Provide valves of the flexible wedge disc, conduit disc, or double disc type. Rising stem type with closed yoke, or nonrising stem type equipped with a device to give positive visual indication of the valve's position; bevel or spur gear operated, except valves 300 mm 12 inches and smaller may be handwheel operated.

2.13.2 Ball Valves

NOTE: When pipe pigging is not required, use
"reduced bore." When pipe pigging is required, use
"full bore." When both are required, use "reduced
bore" or "full bore" as indicated, and show location
of each on drawings.

API Spec 6D, ANSI Class 150, [reduced bore] [or] [full bore] [as indicated]. [Minimum reduced bore size shall be 55 percent of nominal pipe size.] [Conform to fire test requirements of API Std 607.] Provide nonlubricated double seated type capable of handling two-way shutoff, with weather-proof worm-gear operators, except valves 150 mm 6 inches and smaller may be lever operated with 10 positions or infinitely adjustable positions between full open and full close. Balls in valve sizes 350 mm 14 inches and larger shall have trunnion type support bearings. Valves in carbon steel piping shall have steel bodies with chromium-plated or nickel-plated steel balls. Valves in stainless steel piping and aluminum piping shall have Type 316 stainless steel bodies and balls. Valves shall have stainless steel stems and trim, and Viton or Teflon seats, body seals, and stem seals. [Provide body cavity drain and factory installed drain valve.]

2.13.3 Plug (Double Block and Bleed) Valves

API Spec 6D and MIL-V-12003 Type III, ANSI Class 150, nonlubricated, resilient, double seated, tapered lift, plug type capable of handling two-way shutoff; steel body, chrome-plated interior, and tapered plug of

steel or ductile iron, chrome or nickel plated, supported on upper and lower trunnions, and steel or ductile iron, sealing slips, with Viton seals. 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 and a minimum bore size of 65 percent of nominal pipe size, unless the manufacturer can show an equivalent or greater flow rate with a lower percent percent internal cross sectional area.

2.13.3.1 Valve Operation

Rotation of the handwheel toward open shall lift the plug without wiping the seals and retract the sealing slips so that 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.

2.13.3.2 Relief Valves

ANSI Class 150, steel body. Provide plug valves with automatic thermal relief valves to relieve the pressure buildup in the internal body cavity when the plug valve is closed. Relief valves shall open at 175 kPa 25 psi differential pressure, and discharge to the throat of and to the upstream side of the plug valve.

2.13.3.3 Bleed Valves

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

2.13.4 Plug (PTFE Sieved Tapered Plug) Valves

API Spec 6D and MIL-V-12003 Type IV, ANSI Class 150, non-lubricated. Valve shall have stainless steel body at plug and shall have 360 degree port defining lips to retain the sleeve against deforming into the flow passages, provide abrasion protection, and prevent fuel entry behind sleeve. Plug shall operate with a 90 degree turn for closure.

2.13.5 Check Valves

ASME B16.34, ANSI Class 150, steel body, except as modified herein. Spring-loaded, nonsurge globe type with fully guided (top and bottom) disc with Viton renewable seats.

2.13.6 Relief Valves

ANSI Class 150, steel body, except as modified herein. Set relief at the pressure indicated.

2.13.7 Globe Valves

ASME B16.34, ANSI Class 150, steel body, except as modified herein.

2.13.8 Butterfly Valves

API Std 609, minimum ANSI Class 150. Conform to fire test requirements of API Std 607. Design for bubbletight bidirectional shutoff service at maximum pressure rating. Steel body, except as modified herein. Stainless steel Type 304L or 316 disc, ASTM A 276, Type 416, or ASTM A 564/A 564M, Type 630, stainless steel stem. Teflon with metal backup seal ring. Stem seals capable of withstanding the rated pressure and temperature of the valve seat. Valves 200 mm 8 inches and larger and valves at pump discharge shall have weather-proof worm-gear operators with handwheel. Install valves between ANSI Class 150 pipe flanges. Do not install valves on other flanges such as equipment, strainer, and valve flanges. Provide spool pieces. Provide fusible link type valves where indicated. Provide fusible link and spring assembly to close the valve automatically when the link material melts at 74 degrees C 165 degrees F and to lock the valve in the closed position. [Butterfly valves may conform to MIL-V-24624, and as specified herein.]

2.13.9 Wafer Type Check Valves

API Spec 6D and API Std 594, ANSI Class 150. Wafer type check valves may be provided in lieu of swing-check valves in piping sizes larger than 100 mm 4 inches. Valves shall have ASTM A 351/A 351M, Grade CF8M stainless steel disc and seal material; 316 stainless steel spring, hinge pin, stop pin, and radial-thrust bearing materials. Install valves between ANSI Class 150 pipe flanges.

2.13.10 Pump Pressure Relief Valves

ANSI Class 150, with flanged end connections, and position indicator. Hydraulically operated, diaphragm type, modulating, globe valve actuated by pipe line pressure through a pilot control system designed to open fast to maintain a constant pipe line pressure but close gradually to prevent surges; pressure fully adjustable, direct-acting, spring-loaded, diaphragm type designed to permit flow when the controlled pressure is greater than the predetermined spring setting; aluminum alloy 6061-T6 or 356-T6 valve body, stainless steel main valve trim and control pilot system and rubber parts of Viton or Buna-N. When diaphragm fails, the valve shall close. Valve shall have position indicator, pilot circuit strainer, and pressure gage quick-disconnect fittings located in valve inlet, outlet, and cover.

2.13.11 Surge Control and Check Valves

ANSI Class 150, with flanged end connections, and position indicator. Hydraulically operated, pilot-controlled, diaphragm type, nonsurge globe valve with closing time of one to five seconds; locate on the discharge side of the transfer pump. Valve shall automatically prevent reverse flow and open at a controlled rate to keep pump starting surges from shocking downstream equipment. Opening rate shall be adjustable from 5 to 60 seconds. Aluminum alloy 6061-T6 or 356-T6 valve body, stainless steel main valve trim and control pilot system; rubber parts of Viton or Buna-N. Provide orifice plates by valve manufacturer. When diaphragm fails, the valve shall open. Valve shall have position indicator, pilot circuit strainer, and pressure gage quick-disconnect fittings located in valve inlet, outlet, and cover.

2.13.12 Solenoid Control Valves

ANSI Class 150, with flanged end connections, and position indicator.

Hydraulically operated, pilot-controlled, diaphragm type globe valve, with a tight shutoff down to 1379 kPa (gage) 200 psig operating pressure. When energized, the solenoid controls shall cause the main valve to open and function normally. When deenergized, the solenoid controls shall cause the main valve to close, providing a driptight shutoff. Provide NEMA 7 solenoids. Aluminum alloys 6061-T6 or 356-T6 valve body; stainless steel main valve trim and control pilot system; rubber parts of Viton or Buna-N. When diaphragm fails, the valve shall close. Valve shall have position indicator, pilot circuit strainer, and pressure gage quick-disconnect fittings located in valve inlet, outlet, and cover.

2.13.13 Truck Fueling Flow Controller Valve

ANSI Class 150, with flanged end connections, and position indicator. Hydraulically operated, pilot-controlled, diaphragm type globe valve, capable of limiting flow rate regardless of varying inlet pressures. Provide with an adjustable low flow start period, and thermal-relief function. Functions shall be externally adjustable. Provide NEMA 7 solenoids for truck fill high level shutoff and hand held deadman control system. Aluminum alloy 6061-T6 or 356-T6 valve body, stainless steel main valve trim and control pilot system; rubber parts Viton or Buna-N. When diaphragm fails, the valve shall close. Valve shall have position indicator, and pilot circuit strainer.

2.13.14 Aircraft Fueling Flow Control Valve 100 mm 4 Inch

ANSI Class 150, with flanged end connections, and position indicator. Hydraulically operated, pilot-controlled diaphragm type globe valve, capable of regulating downstream pressure to a maximum of 345 kPa (gage) 50 psig using a remote pressure signal from a venturi. The valve shall have opening speed controllers. Functions shall be externally adjustable. Provide NEMA 7 solenoid control, suitable for deadman operation. Provide safe hand held deadman control with 7.50 meters 25 feet cable. Aluminum alloys 6061-T6 or 356-T6 valve body. Stainless steel main valve trim and control pilot system; rubber parts of Viton or Buna-N. Provide venturi for each fueling valve. When diaphragm fails, the valve shall close. Valve shall have position indicator and pilot circuit strainer.

2.14 PIPING ACCESSORIES

2.14.1 Pipe Hangers and Supports

NOTE: Drawings should show details and spacing of pipe supports and include appropriate seismic zone design requirements.

MSS SP-58 and MSS SP-69, of the adjustable type, except as modified herein or indicated otherwise. Provide steel pipe hangers and supports. The finish of rods, nuts, bolts, washers, hangers, and supports shall be hot-dip galvanized.

2.14.1.1 Pipe Protection Shields

MSS SP-58 and MSS SP-69, Type 40, except material shall be Type 316 stainless steel. Provide at each slide type pipe hanger and support.

2.14.1.2 Low Friction Supports

Supports shall have self-lubricating antifriction bearing elements composed of 100 percent virgin tetrafluoroethylene polymer and reinforcing aggregates, prebonded to appropriate backing steel members. The coefficient of static friction between bearing elements shall be 0.06 from initial installation for both vertical and horizontal loads and deformation shall not exceed 0.05 mm 0.002 inch under allowable static loads. Bond between material and steel shall be heat cured, high temperature epoxy. Design pipe hanger and support elements for the loads applied. Antifriction material shall be a minimum of 2.30 mm 0.09 inch thick. Steel supports shall be hot-dip galvanized. Units shall be factory designed and manufactured.

2.14.1.3 Miscellaneous Metal

ASTM A 36/A 36M, standard mill finished structural steel shapes, hot-dip galvanized.

2.14.1.4 Anchors, Bolts, Nuts, Washers and Screws

Hot-dip galvanized steel, except provide Type 316 stainless steel bolts, nuts, washers, and screws under piers.

2.14.2 Strainers

Provide 'S' or 'T' pattern, [duplex type], except as modified herein. Flanged end connections shall be designed in accordance with ASME B16.5, Class 150; steel bodies, except Type 304 or 316 stainless steel, and 3003, 6061, or 356-T6 aluminum alloys. Strainers shall have removable baskets of 7-mesh, Type 316 stainless steel wire screen unless other mesh is indicated. Pressure drop for clean strainer shall not exceed 21 kPa (gage) 3 psig at design flow rates. Provide strainer with air eliminator.

2.14.3 Gages

ASME B40.100, single style pressure gage for fuel with 114 mm 4.5 inch dial, brass or aluminum case, bronze tube, stainless steel ball valve, pressure snubbers, and scale range for the intended service.

2.14.4 Flexible Ball Joints

NOTE: Drawings should show location and details of
each pipe expansion joint, amount of pipe movement,
and pipe anchors.

Carbon steel with polished steel balls 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 and joints designed for minimum working pressure of ANSI Class 150.

2.14.5 Bellows Expansion Joints

NOTE: Drawings should show location and details of
each pipe expansion joint, amount of pipe movement,

and pipe anchors.

Provide Type 304 stainless steel corrugated bellows, reinforced with rings, internal sleeves, external protective covers, and ASME B16.5, Class 150 flanged end connections. Provide limit stops to limit total movement in both directions. Cold set the joints to compensate for temperature at time of installation. Design to withstand 10,000 cycles over a period of 20 years, and for minimum working pressure of ANSI Class 150. Provide single or double bellows expansion joint as indicated. Provide first pipe alignment guide no more than four pipe diameters from the expansion joint. Provide second pipe alignment guide no more than 14 pipe diameters from the first guide.

2.14.6 Pipe Sleeves

Provide where piping passes through walls and floors. Grout sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls and floors with a minimum 25 mm one inch clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Seal space with a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, calk both ends of pipe sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.14.6.1 Sleeves in Masonry and Concrete Walls and Floors

Provide hot-dip galvanized steel, ductile-iron, or cast-iron pipe sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves provided that cavities in the core-drilled hole are completely grouted smooth.

2.14.6.2 Sleeves in Other Than Masonry and Concrete Walls and Floors

Provide galvanized steel sheet sleeves having a minimum nominal weight of 43 Pa 0.90 psf.

2.14.7 Flexible Pipe Connections

Connection shall be a stainless steel, single-braided, close helical type hose with ANSI Class 150 end connections. Connection shall have sufficient length to absorb 3.20 mm 0.125 inch lateral movement. Hose shall have a minimum working pressure of 1896 kPa (gage) at 38 degrees C 275 psig at 100 degrees F.

2.14.8 Temporary Conical Strainers

Provide steel pipe spool piece 300 mm 12 inches long with ANSI Class 150 welding neck flanges on each end of the spool piece, and of the same diameter as the ANSI Class 150 flanges on the connecting piping. Strainers shall be designed to be installed between flanges, with strainer body within the spool piece. Strainer shall be constructed of stainless steel with 6.35 mm 0.25 inch diameter holes, and lined with 60-mesh stainless steel wire screen.

2.15 EQUIPMENT

Design pressure components of equipment for minimum working pressure of ANSI Class 150. Metal contacting the fuel in aviation fuel systems shall

be stainless steel Types 304 or 316, or aluminum alloys 3003, 6061-T6, or 356-T6, except as modified in paragraph entitled "Special Requirements," in this section.

2.15.1 Filter Separator Units

[MIL-F-27630 for up to 38 liters per second 600 gpm capacity] [and] [MIL-F-83402 for up to 76 liters per second 1200 gpm capacity], except as modified herein. Unit shall be horizontal or vertical type as indicated. Design units for use with fuels conforming to MIL-DTL-5624 and MIL-DTL-38219. Filter water separator elements shall conform to MIL-PRF-52308. Provide piston type direct-reading pressure differential gage wherein the piston moves downward in a glass cylinder along a zero to 200 kPa 30 psi graduated scale; permanent set of the spring (loss of calibration) must be clearly visible by the position of the piston when there is no differential pressure. Provide one complete set of elements for each unit. Furnish one complete spare set of coalescer elements for each unit. Automatic water sump drain valve may be copper alloy.

2.15.2 Fuel Quality Monitors

MIL-PRF-81380, except as modified herein. Stainless steel Type 304 or 316 or aluminum alloys 3003 or 6061 fabricated housing with flanged inlet and outlet, two gage taps, an air release tap complete with automatic air eliminator, and a 20 mm 0.75 inch drain valve. The fuel quality monitor elements shall also conform to MIL-PRF-81380 for test procedures and performance requirements, except elements shall be of the slow-closing, water-absorbing type. Provide piston type direct-reading pressure differential gage wherein the piston moves downward in a glass cylinder along a zero to 207 kPa 30 psi graduated scale; permanent set of the spring must be clearly visible by the position of the piston when there is no differential pressure. Provide one complete set of elements for each unit and a calibrated tag showing differential pressure versus fuel flow for clean and dirty elements. Furnish one complete spare set of elements for each unit.

2.15.3 Fuel Meters

**NOTE: Use words enclosed in brackets only for truck
loading stations.**

FS A-A-59248, except as modified herein. Meters shall have a minimum working pressure of 1896 kPa (gage) at 38 degrees C 275 psig at 100 degrees F. Metals in contact with fuel shall be stainless steel Types 304 or 316, or aluminum alloys 3003, 6061-T6, or 356-T6, except as modified in paragraph entitled "Special Requirements," in this section. Meters shall be of the continuous duty, positive displacement type, with electronic thermal compensation capability, flanged end connections, designed for outdoor installation. Meter adjustment shall be possible while under pressure, without leakage or loss of product and without requiring disassembly other than removal of the cover plate. Meters shall be capable of momentary overspeeding to 125 percent of maximum rated capacity without damage or impairment of accuracy. Provide [with a two-stage set stop counter register,] with seven-figure nonsetback totalizer and five-figure setback run indicator without the 0.40 liter tenth-of-gallon indicator. Provide counter with electrical impulse to solenoid valves that are on the two-stage fueling flow control valves. Pressure drop across each meter

shall not exceed 41 kPa (gage) 6 psig when operated at rated capacity.
Each meter shall be factory calibrated. Provide meters with card printer.

2.15.4 Fuel Pumps

NOTE: Drawings should show details, capacity, efficiency, and electrical characteristics for each pump. Refer to pump Military Specification and specify ordering data in complete detail for each pump.

Design shall provide for nonoverloading characteristics throughout the entire head capacity curve under operating conditions. Metal contacting the fuel shall be stainless steel or aluminum alloy, except impellers shall be stainless steel.

2.15.4.1 Turbine Pumps

Provide antivortex device which allows pump removal without entering the tank.

2.15.4.2 Centrifugal Pumps

MIL-P-52327, except as modified herein.

2.15.5 Pantograph Fueling Stations

NOTE: Drawings should show complete details of pantograph fueling station, including fuel meter, and fueling control valve which should provide: intrinsically safe hand held deadman control, constant downstream pressure, surge control when flow is stopped suddenly, and expansion relief for trapped downstream fuel. The system shall also include approved pantograph swivels, emergency dry breakaway coupling, hose, dry break coupling with 60 mesh screen, hose end pressure limiter, and single point fueling nozzle with Gammon QD sample connection.

Provide valves, meters, piping, discharge manifolds, pantograph, and hose. Metal in contact with the fuel shall be stainless steel or aluminum alloys as specified herein. Provide pushbutton station with on-off (green/red) indicating lights for pump control and hand held deadman for on/off flow control of fueling control valve. Station shall include but not be limited to the following components:

2.15.5.1 Fusible Link Shutoff Valves

Fusible link wafer trunnion 150 mm 6 inch valve, with 74 degree C 165 degree F fusible link and a completely enclosed spring operator.

2.15.5.2 Meter

Provide 38 liters per second 600 gpm meter as specified herein.

2.15.5.3 Refueling Valve

Provide as specified herein.

2.15.5.4 Relief Valve

Provide as specified herein.

2.15.5.5 Venturi

NOTE: Venturi is required in aircraft fueling stations.

Provide for compensated pressure regulation of each refueling valve. The venturi shall be sized to compensate for pressure drop of entire pantograph assembly at minimum design flow rate. The amount of recovery shall be adjustable and the maximum unrecoverable pressure drop at 38 liters per second 600 gpm shall be less than 69 kPa 10 psi.

2.15.5.6 Pantograph Assemblies

NOTE: For fixed wing aircraft direct fueling station, use 80 mm 3 inch diameter hose and 80 mm 3 inch diameter emergency breakaway coupling.

NOTE: For helicopter direct fueling station, use 50 mm 2 inch diameter hose and 50 mm 2 inch diameter emergency breakaway coupling.

Assembly shall include 100 mm 4 inch diameter Schedule 80 ASTM B 241/B 241M, alloy 6061-T6 nominal 7 meters 24 feet aluminum pipe arm sections. Components shall be constructed of aluminum alloy or stainless steel. Swivel joints shall be constructed of aluminum stainless steel and shall be NAVFAC/NAVAIR approved. Anchor end swivel joints, intermediate swivel joints, and hose end swivel joints shall have 100 mm 4 inch flanged connections capable of 360-degree rotation. Intermediate and end swivel joints shall have 200 mm 8 inch diameter solid oil resistant polymer tiers. The assembly shall also include an emergency dry break swivel coupling, a 3 meters 10 foot length of [80] [50] mm [3] [2] inch aircraft fueling hose, a dry break swivel coupling with 60-mesh strainer, and a 345 kPa (gage) 50 psig hose end regulator, and SAE AS5877 nozzle. Provide a draw bar or pull cable with handle for positioning the pantograph. Connect the hose to the last swivel in the pantograph assembly through a [80] [50] mm [3] [2] inch emergency breakaway coupling to allow dry breakaway at 890 Newton 200 pounds tensile loading. The assembly shall be factory-assembled including required gaskets, brackets, hose storage rack, nozzle holder, and support casters. Pantograph assemblies shall be capable of developing the total length as indicated, including the hose. Provide assemblies which have an electrical conductivity reading throughout the entire length of the pantograph including hardware and nozzle. The approved swivels are Aeroquip single plane, Chiksan 2-plane, EMCO Wheaton single plane and CLA-VAL 2-plane.

2.15.5.7 Emergency Breakaway

Unit shall operate independently of internal pressure and separate at 890 (plus 222 to minus 111) Newton 200 (plus 50 to minus 25) pounds tensile pull and be capable of reinstallation without replacement parts.

2.15.5.8 Fueling Hose

NFPA 407 and API Std 1529, Grade 3, Type A or Type C, semi-hardwall, 80 mm 3 inch hose designed for use with the specified fuel for a working pressure of 2068 kPa (gage) 300 psig. Hose shall be constructed of braided synthetic cord surrounded by an interior rubber tube and an exterior rubber cover. Provide permanent brass couplings and bonding wire wrapped a minimum of 10 coils around the exterior of the hose and connected to both couplings.

2.15.5.9 Nozzles

SAE AS5877, 65 mm 2.5 inch fueling nozzle of the type designed for the single point fueling of aircrafts at a flow rate of 38 liters per second 600 gpm with a maximum pressure drop of 207 kPa 30 psi, and a 65 mm 2.5 inch hose end regulator to limit the downstream pressure to 379 kPa (gage) 55 psig maximum, a dry break coupling with 60-mesh stainless steel strainer, and fuel sample connection tapping.

2.15.5.10 Nozzle Adapters

Provide 65 mm 2.5 inch nozzle adapter with self-closing valve in accordance with MS 29514 and 100 mm 4 inch flange mounting and dust cap.

2.15.5.11 Pressure Gage Quick Disconnect and Fuel Sample Connectors

Quick disconnects shall be compatible throughout the piping systems, fit in 9.50 mm 0.375 inch ports and extend outward less than 21.30 mm 0.84 inch from the port boss. Provide an aluminum dust plug with chain. [NOTE: Gammon GTP-235-3/8 Jet Test QD will meet this specification.]

2.15.5.12 Pressure Gages

ASME B40.100, single style for fuel with 114 mm 4.5 inch dial, pressure scrubber, dry break disconnect, and isolation valve with scale range for the intended service.

2.15.5.13 Temporary Conical Strainers

Provide as specified herein.

2.15.6 Relaxation Tanks

API RP 2003; constructed of the same material as the filter/separator with air eliminator, pressure relief valve, drain valve, and internal baffling to prevent flow short circuiting. Relaxation time at maximum flow rate of the system shall be a minimum 30 seconds from the last filter or monitor to the exit point in a tank that may contain air. Provide ASME pressure vessel seal on tank.

2.15.7 Tank Truck Bottom Loading Stations

NOTE: Drawings should show complete details of tank truck bottom loading station including strainer, filter separator, water slug control valve, fuel monitor, fuel meter, 30-second relaxation tank, and a nozzle basket and holding tray to hold the hose and nozzle when not in use. Flow control should have adjustable timer to allow maximum of **one meter per second 3 fps** initial flow; limit to 50 percent full flow until liquid level is approximately **150 mm 6 inches** deep, and then open wide. Deadman control should provide start and stop of fuel. High level shutoff control shall provide visual and audible alarm, deadman control override, ground continuity check, and shall be intrinsically safe and self-checking during fueling operations. Provide Scultrol self-monitoring high level shutoff system.

Metal in contact with fuel shall be stainless steel or aluminum alloys. The loading assembly shall include an approved swivel joint, **API Std 1529**, grade 3 type A or type C **80 mm 3 inch** diameter hose, and loading nozzle. Swivel joints shall permit a 360-degree swing in either direction and shall be of the approved type. [The leading assembly shall be a counter balanced loading arm fabricated with an approved swivel and loading nozzle.] Provide self-monitoring high level shutoff system with hand held deadman control for fueling control valve.

2.16 PROTECTIVE COATINGS FOR PIPING

2.16.1 Protective Coatings for Aboveground Carbon Steel Piping

Coat piping and appurtenances in accordance with Section **09 97 13.27**, EXTERIOR COATING OF STEEL STRUCTURES.

2.16.2 Coatings For Underground Piping

Protective Coatings for Buried Carbon Steel, Stainless Steel, and Aluminum Piping [and for Piping Under Piers]: Provide pipe with protective coating system of factory-applied adhesive undercoat and continually extruded polyethylene coating conforming to **NACE SP0185**, Type A. The protective coating shall have a minimum thickness of **762 micrometers 30 mils** for pipe sizes smaller than **152.4 mm 6 inches**; minimum thickness shall be **0.90 mm 36 mils** for pipe sizes **150 mm 6 inches** and larger.

2.16.3 Damaged Areas of Pipe Coating

Provide polyethylene tape which conforms to **NACE SP0169** and **NACE RP0190 762 micrometers 30 mils** nominal thickness over damaged areas.

2.16.4 Fittings, Couplings, and Regular Surfaces

Provide polyethylene tape which conforms to **NACE SP0169** and **NACE RP0190 762 micrometers 30 mils** nominal thickness overlapped a minimum **25 mm one inch** over damaged areas.

2.17 BONDING

NFPA 70 for materials and workmanship. The fuel piping system shall be bonded in metallic contact to provide electrical continuity to fixed and moving components for grounding the entire system. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components. Minimum size ground conductor shall be No. 6, with single covered, flexible, stranded, copper conductor, Type RR-USE. Provide dielectric connection in riser pipe for underground piping protected by impressed current.

2.18 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in minimum **80 mm 3 inch** width rolls, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.19 MANHOLE DRAINERS (SUMP PUMPS)

Provide factory assembled and tested submersible type pumps for operation under water. Provide pump complete with cast-iron casing, bronze impeller, stainless steel shaft, sealed heavy-duty ball bearings, water-cooled hermetically sealed electric motor, built-in automatic reset thermal protection, float switches, high water alarm, and waterproof three-conductor cables with grounding plugs.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Demolition

Remove materials so as not to damage materials which are to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction. [The Government will drain the existing piping insofar as practicable with the existing pumps. The Contractor shall be responsible for removing the remaining fuel and sludge, and for cleaning and inerting the piping to make it safe for welding.]

3.1.2 [Protection

Portions of the work must be accomplished on piping suspended beneath the pier deck; therefore, it is imperative that the Contractor take precautions to guard against the spillage of fuel on to the pier or into the water.]

3.2 INSTALLATION

Provide exterior aviation fuel distribution systems including above ground piping, buried piping, piping in manholes, dispensing hardware and related work. Install piping straight and true to bear evenly on supports. Install valves with stems horizontal or above. Install flanges and unions at valves, connections to equipment, and where indicated. The work includes installing piping up to and including the pumping equipment and valves within each building. Provide each system complete and ready for

operation. Equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with [ASME B31.3](#) and [NFPA 30](#), except as modified herein.

3.2.1 Protection Against Hazardous Conditions

The piping and the surrounding area shall be inspected for explosive vapors prior to work and frequently during the course of the work. If, in the opinion of the Contracting Officer, a hazardous condition exists, work shall cease until such condition has been corrected.

3.2.2 Safety

[NFPA 30](#) and [NFPA 407](#); safety rules shall be strictly observed. The flash points of fuels in degrees [Centigrade Fahrenheit](#) are as follows:

<u>FUELS</u>	<u>FLASH POINT</u>
Aviation Gasoline (Avgas)	Minus 46
Jet Fuel JP-4	Minus 29
Jet Fuel JP-5	Plus 60
Jet Fuel JP-7	Plus 66

<u>FUELS</u>	<u>FLASH POINT</u>
Aviation Gasoline (Avgas)	Minus 50
Jet Fuel JP-4	Minus 20
Jet Fuel JP-5	Plus 140
Jet Fuel JP-7	Plus 150

3.2.3 Connections To Existing Systems

Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; receive approval before interrupting service. Provide materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required.

3.2.4 Cutting Existing Pipe

Perform the initial cutting of the existing piping with a multiwheel pipe cutter, using a nonflammable lubricant. After cutting, seal the interior of the piping with a gas barrier plug in accordance with [API BULL 2209](#). The interior of the piping shall be purged with carbon dioxide or nitrogen during welding process. The complete method of cutting, sealing, and welding shall be approved in advance of the actual work.

3.2.5 Cleaning of Piping

Keep the interior and ends of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

3.3 PIPE AND FITTINGS

Inspect, test, and approve piping before burying, covering, or concealing.

Provide fittings for changes in direction of piping and for connections. Reducing branch connections in steel piping may be made with forged branch outlet reducing fittings for branches two or more pipe sizes smaller than mains. Branch outlet fittings shall be forged, flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Stub type connections are prohibited. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste or PTFE powder and oil. Pipe nipples 150 mm 6 inches long and shorter shall be Schedule 80 pipe. Make changes in piping sizes through tapered reducing pipe fittings.

3.3.1 Fittings and End Connections

Install threaded fittings and end connections for sizes less than 25 mm one inch; threaded or socket-welding or buttwelding fittings and end connections for sizes 25 to 50 mm one to 2 inches; threaded connections for threaded valves, traps, strainers, and threaded connections to equipment; buttwelding fittings and end connections for sizes 65 mm 2.5 inches and larger; and flanged connections for flanged valves, traps, strainers, and flanged connections to equipment.

3.3.2 Pipe Hangers and Supports

NOTE: Drawings should show details and spacing of pipe supports and include appropriate seismic zone design requirements.

Install additional hangers and supports for the concentrated loads in piping between hangers and supports, such as for valves. Install ASTM A 36/A 36M miscellaneous steel shapes as required. [After installation of piping under piers, coat pipe hangers and supports including rods, bolts, nuts, and washers, with two coats of coal tar mastic applied a minimum total dry film thickness of 0.80 mm 30 mils.] Support piping as follows:

Nominal Pipe Size (mm)	One and Under	40	50	80	100	150	200	250	300
Maximum Hanger Spacing (meters)	2	2.75	3	3.5	4.25	5	5.75	6.50	7.0

Nominal Pipe Size (Inches)	One and Under	1.5	2	3	4	6	8	10	12
Maximum Hanger Spacing (Feet)	7	9	10	12	14	17	19	22	23

3.3.3 Anchors, Bolts, Nuts, Washers, and Screws

Install where required for securing the work in place. Sizes, types, and spacings of anchors and bolts not indicated or specified shall be as required.

3.4 PROTECTIVE COATINGS FOR ABOVEGROUND CARBON STEEL PIPING

For aboveground piping, coat piping and appurtenances in accordance with Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES.

3.4.1 Damaged Materials

For both above and below ground piping, 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. Waterproof shrink sleeves may be provided using electric heating method 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. [Apply pipe coating on piping under piers with finish paint coat as approved by pipe coating system manufacturer.]

3.4.2 Pipe Coating

For both above and below ground piping, residual material from 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.

3.4.3 Fitting Coating

For both above and below ground piping, stretch and apply first layer of tape to conform to component's surface. Apply and press a second layer of tape over first layer of tape.

3.4.4 Flange, Valve and Irregular Surface Coating

For both above and below ground piping, apply coal tar base coating to a minimum dry film thickness of 0.80 mm 30 mils.

3.4.5 Exterior Coatings for Underground Piping

Except as otherwise specified, protective coating shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective coating applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically. Piping installed in valve boxes or manholes shall also receive the specified protective coating.

3.4.5.1 Regular Surfaces, Fittings, and Couplings

Tape shall be initially stretched sufficiently to conform to the surface to which it is applied, using one layer lapped at least 25 mm 1 inch. Tape shall overlap the extruded polyethylene coated piping 75 mm 3 inches at all joints. A second layer, lapped at least 25 mm 1 inch, with a tension as it comes off the roll shall be applied and pressed to conform to the shape of the component.

3.4.5.2 Damaged Areas of Extruded Polyethylene Coating

Residual material from coating shall be pressed into the break or trimmed off. Tape shall be applied spirally and one-half lapped as it is applied. Tape shall extend 75 mm 3 inches beyond the damaged area. A double wrap of one full width of tape shall be applied at right angles to the pipe axis to seal each end of the spiral wrapping.

3.4.5.3 Existing Piping Affected by the Contractor's Operation

Pipe shall be wrapped to 75 mm 3 inches beyond the point of connection.

3.5 CATHODIC PROTECTION

**NOTE: The need for cathodic protection should be
evaluated on an individual project basis.**

Install cathodic protection systems for buried metallic piping systems. Final adjustments for impressed current systems shall be accomplished by a certified National Association of Corrosion Engineer (NACE).

3.6 BURIED UTILITY WARNING

Warning tape shall read "CAUTION BURIED FUEL PIPING BELOW" or similar wording. Bury tape with the printed side up at a depth of 300 mm 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.7 CONCRETE MANHOLES

Install under this section as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete shall have a minimum strength of 30 MPa 4000 psi, air entrained admixture 133 gram per cubic meter 3.6 ounces per cubic yard, with water-reducing admixture 814 gram per cubic meter 22 ounces per cubic yard, reinforced with deformed steel bars. Construct manhole bottom and sides by one monolithic pour with concrete sections a minimum 200 mm 8 inches thick an extending a minimum 150 mm 6 inches above grade. Manhole bottom shall have 356 mm 14 inch round or square sump by 305 mm one foot deep. Cast-iron steps with nonslip surfaces, spaced 300 to 406 mm 12 to 16 inches apart oc, shall be firmly embedded in concrete walls for access to bottom of manholes. Manhole top shall be [cast concrete slab of the same strength and thickness as the manhole].

3.8 NAMEPLATES

Attach laminated plastic nameplates to equipment, gages, thermometers, and valves. Nameplates shall be Melamine plastic, 3 mm 0.125 inch thick, black with white center core, matte finish surface and square corners. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 25 by 65 mm one by 2.5 inches. Lettering shall be minimum of 6 mm 0.25 inch high normal block style. Key the nameplates to a chart and schedule for each system. Frame charts and schedule under glass, and locate where directed near each system. Furnish two copies of each chart and schedule. Each nameplate inscription shall identify its function. Equipment nameplates shall show the following information:

- a. Manufacturer, type, and model number;

- b. Contract number and acceptance date;
- c. Capacity or size;
- d. System in which installed; and
- e. System which is controlled.

3.9 FIELD QUALITY CONTROL

3.9.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

3.9.2 Piping Tests

NOTE: On projects that provide modifications to existing piping systems, pneumatic pressure testing and hydraulic pressure testing of newly installed piping is much more difficult than the same testing on a complete new system. Therefore, by means of the following design techniques, provide for the Contractor a piping modification design that facilitates acceptance testing: piping design which includes flanges at appropriate locations for flanged blanks to be installed for testing; specifications which include requirements for how the modified piping shall be pressure tested; specifications which specify which pipe sections shall be pressure tested in the shop if absolutely necessary.

Before final acceptance of the work, test each system as in service to demonstrate compliance with contract requirements.

3.9.2.1 Pneumatic Test

Pneumatically test each piping system to 172 kPa (gage) 25 psig, examine joints with soap solution. Gradually increase to 345 kPa (gage) 50 psig and hold for 1 hour. The pneumatic test is more hazardous than a hydrostatic test, therefore, special safety measures, including the wearing of face masks, shall be taken during testing under pressure. Only authorized personnel shall be permitted in the area during pneumatic and hydrostatic testing.

3.9.2.2 Hydrostatic Tests

Upon completion of pneumatic testing, hydrostatically test each piping system at 1.5 times maximum system operating pressure but in no case more than 1896 kPa (gage) 275 psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gage pressure for 4 hours. Thoroughly flush piping before placing in operation. Flush piping, including branch piping, at a minimum velocity of 2.40 meters 8 feet per second. Correct defects in work provided by the Contractor and repeat tests until work is in compliance with contract requirements. Furnish electricity,

instruments, connecting devices, and personnel for the tests. Government will furnish fuel for for piping testing and flushing provided by the Contractor. Contractor shall be responsible for losses greater than 10 percent.

3.9.3 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 1000 times the square root of the average coating thickness in mils. Tester shall be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer shall be required at 6-month intervals or at such time as crest voltage is questionable. 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. Upon completion of installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays.

3.9.3.1 Exterior Coatings of Underground Piping

The coating system shall be visually inspected for holes, voids, cracks, and other damage during installation. Damage to the protective coating incurred during transit and handling shall be repaired before installation. Before lowering into the trench, each pipe section shall be tested by an electric holiday detector with impressed current in accordance with [NACE RP0274](#), using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. Holidays in the protective coating shall be repaired immediately upon detection and retested. The holiday detector shall be a type that field adjustments cannot be made. Calibration of the tester shall be performed by an independent testing manufacturer at 6-month intervals or at such time as the crest voltage is questionable. Following installation, but prior to filling the system with fuel, all exterior protective coatings, including field joints, shall be retested with an electric holiday detector as described above. Holidays in the protective coating shall be repaired immediately upon detection and retested. Extreme care shall be taken in lifting the piping to perform the testing procedure. Chains or metal ropes shall not be used in lifting the pipe for testing. Labor, materials, and equipment necessary for conducting the holiday tests shall be furnished by the Contractor.

3.9.4 Equipment Acceptance Tests

**NOTE: Write detail acceptance test for each item of
equipment using the latest state of the art.**

3.9.5 System Acceptance Test

**NOTE: Write a detailed acceptance test for system
operation and issue fuel quality. Aircraft direct
fueling systems should be able to issue design flow
rates at specified minimum pressures. Aircraft fuel
quality issue shall meet use limits contained in**

NAVAIRINST 10340.3, "Maintaining Quality and
Limiting Contaminating of Aircraft Fuels" available
from NAVAIRHQ (AIR 5363) AV 222 2653. In general
fuel to aircraft limit on freewater is 5ppm and 2
mg/liter on particulates.

3.10 FIELD PAINTING

After completion of field inspections and tests, clean and paint carbon steel surfaces exposed to the weather and in manholes, including valves, strainers, traps, flow meters, piping flanges, bolts, nuts, washers, pipe hangers, supports, expansion joints, and miscellaneous metal. Do not paint stainless steel or aluminum surfaces. Clean surfaces to remove dust, dirt, rust, oil, and grease. Apply two coats of enamel paint to a total minimum dry film thickness of 0.051 mm 2 mils. Apply the second coat of paint after the preceding coat is thoroughly dry.

-- End of Section --