SECTION 15060

PIPE, MANUAL VALVES, AND FITTINGS
(Revised 30 Oct 2003)

INDEX

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PART 1 GENERAL

1.1 APPLICABLE PUBLICATIONS

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

FEDERAL SPECIFICATIONS (FED. SPEC.)

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

MILITARY SPECIFICATIONS (MIL. SPEC.)

MIL-C-4556D(1)	Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-V-12003F(1)	Valve, Plug, Cast Iron or Steel, Manually Operated
MIL-S-13789C	Strainers, Sediment: Pipeline, Basket Type

MILITARY STANDARDS (MIL-STD)

MIL-STD-161F (Notice 2)	Identification Methods for Bulk Petroleum Products System Including Hydrocarbon Missile Fuels
MIL-STD-271F	Nondestructive Testing Requirements for metals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B1.1-82	Unified Inch Screw Threads
B16.5-81	Pipe Flanges and Flanged Fittings
B16.9-78 (AMD 81)	Factory Made Wrought Steel Butt Welding Fittings
B16.11-80	Forged Steel Fittings, Socket-Welding and Threaded
B16.21-78	Nonmetallic Gaskets for Pipe Flanges
B18.2.1-81	Square and Hex Bolts and Screws, Inch Series Including Hex Cap Screws and Lag Screws
B18.2.2-72	Square and Hex Nuts

(R83)

B31.3-84	Chemical Plant and Petroleum Refinery Piping
Z49.1-83	Welding and Cutting, Safety in

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

A53-87A	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A105/A105M-87	Forgings, Carbon Steel, for Piping Components
A167-87	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A181/A181M-85	Forgings, Carbon Steel, for General Purpose Piping
A182-84	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
A193-85	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
A194-85	Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
A234/A234-M 1986	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
A269-87	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A312/A312M-86	Seamless and Welded Austenitic Stainless Steel Pipe
A312/A358M-89	Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High Temperature Service
A403/A403M-86	Wrought Austenitic Stainless Steel Piping Fittings
A450/450M-87	General Requirements for Carbon, Ferritic Alloy and Austenitic Alloy Steel Tubes
D229-86	Rigid Sheet and Plate Materials Used for Electrical Insulation, Method of Testing
E94-84	Radiographic Testing
F436-86	Standard Specification for Hardened Steel Washers

AMERICAN WELDING SOCIETY (AWS)

A2.4-86	Symbols for Welding and Nondestructive Testing, Including Brazing
A3.0-85	Standard Welding Terms and Definitions Including Terms for Brazing, Soldering, Thermal Spraying and Thermal Cutting
A5.1-81	Steel, Carbon, Covered Arc Welding Electrodes
A5.4-81	Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Electrodes
A5.5-81	Steel, Low-Alloy, Covered Electrodes, Welding Electrodes

AMERICAN PETROLEUM INSTITUTE (API)

5L-87	Line Pipe
6D-82	Pipeline Valves
607-85	Fire Test for Soft-Seated Ball Valves
RP6FA-85	Fire Test for Valves
RP1110-81	Recommended Practices for Pressure testing of Liquid Petroleum Pipelines

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1986	Boiler and Pressure Vessel Code, Section VIII: Pressure Vessels, Division I.

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

SP-58-83	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-69-83	Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

30-1987	Flammable and Combustible Liquids Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) STANDARD

J514-1980	Hydraulic Tube Fittings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

587-80	Surge Voltages in Low-Voltage AC Power Circuits

1.2 SUBMITTALS

The submittal requirements of Section entitled ["Mechanical General Requirements"] ["General Requirements"] applies to the following lists. All items shall be submitted for Government approval.

NOTE: SELECT SECTION ENTITLED "MECHANICAL GENERAL REQUIREMENTS" FOR NAVFACENGCOM PROJECTS OR SECTION ENTITLED "GENERAL REQUIREMENTS" FOR C.O.E. PROJECTS.

1.2.1 Manufacturer's Data:

a. Piping

b. Fittings

c. Manual Valves

d. Pipe Hangers and Supports

e. Flexible Ball Joints

f. Strainers

g. Protective Coatings

h. Sample Connections

i. Isolating Gasket Kits

j. Gaskets

k. Flexible Hoses

1.2.2 Shop Drawings:

a. Manual Valves

b. Strainers

c. Pipe Hangers and Supports

d. Flexible Hoses

1.2.3 Certificates of Compliance:

a. Piping

b. Fittings

c. Manual Valves

d. Surface Preparation

e. Protective Coatings

f. Welder's Qualifications/Weld Preparation

g. Isolating Gasket Kits

h. Gaskets

1.2.4 OMSI Submittals: OMSI information shall be submitted for the equipment items or systems listed below. Refer to Section 01730, Operation and Maintenance Support Information (OMSI), for the information to be submitted for various type of equipment and systems.

a. Piping

b. Fittings

c. Manual Valves

d. Flexible Ball Joints

e. Strainers

f. Protective Coatings

g. Sample Connections

h. Isolating Gasket Kits

i. Gaskets

k. Flexible Hoses

PART 2 - PRODUCTS

2.1 DESIGN CONDITIONS: Shall be as specified in Section entitled "Mechanical Equipment, Fueling".

2.2. MATERIALS:

2.2.1 General: Pipe and fittings in contact with fuel shall be stainless steel, interior epoxy coated carbon steel or fiberglass reinforced plastic (FRP). Fiberglass reinforced plastic (FRP) is limited to the section of underground piping between the Water Draw-Off Systems and the Product Recovery Tank. All other pipe and fittings shall be interior epoxy coated carbon steel or stainless 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. FRP products shall be specified in Section entitled "Fiberglass Reinforced Plastic (FRP) Piping (for Underground Petroleum Piping)". All carbon steel and stainless steel underground piping shall have a protective coating and shall be cathodically protected in accordance with Section entitled [ ]. Identification of piping shall be in accordance with MIL-STD-161 unless specified otherwise. Material for manual valves shall be as specified hereinafter.

NOTE: INSERT SELECTED CATHODIC PROTECTION SPECIFICATION SECTION.

2.2.1.1 Interior Epoxy Coated Carbon Steel Piping:

a. Piping 12 inch and larger: ASTM A53 Grade B having a wall thickness of 0.375 inch.

b. Piping 2-1/2 inches through 10 inch: Schedule 40S API 5L Grade B or ASTM A53 Grade B.

c. Piping 2 inch and smaller: Schedule 80 API 5L Grade B or ASTM A53 Grade B.

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

e. Interior Epoxy Coating System shall be in accordance with MIL-C-4556, 6-8 mils dry film thickness.

2.2.1.2 Stainless Steel Piping:

a. Piping 8 inch and larger: Schedule 10S ASTM A312 Type 304L, seamless only or ASTM A358, Grade 304L, Class 1 or 3, with wall thickness of 0.25 inch for 8, 10 and 12 inch piping. Factory longitudinal weld shall be 100 percent radiographically inspected in accordance with ASME Boiler and Pressure Vessel Code, Section VIII. Radiographs shall be submitted to the Contracting Officer.

b. Piping 6 inch and smaller: ASTM A312, Grade TP 304L, seamless only, Schedule 40 (minimum).

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

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

2.2.1.3 Protective Coatings for aboveground interior epoxy coated Carbon Steel Piping: Provide painting of aboveground piping, and miscellaneous metal as specified in Section Entitled "Painting of Buildings (Field Painting)". Color of finish coat shall be white. Do not paint stainless steel or aluminum surfaces.

2.2.1.4 Protective Coatings for Buried Carbon Steel and Stainless Steel Piping: Provide pipe with Fed. Spec. L-C-530 coatings system of factory-applied adhesive undercoat and continuously extruded plastic resin coating; minimum thickness of plastic resin shall be 36 mils for pipe sizes 6 inches and larger. Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations shall be clean, dry, grease free, and primed before application of tape. Tape shall overlap the pipe coating not less than 3 inches. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than 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 Fed. Spec. L-T-1512, 20 mils nominal thickness 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 Fed. Spec. L-T-1512, 10 mils nominal thickness tape overlapped not less than 1.0 inch over damaged areas. Initially stretch and apply first layer of tape to conform to component's surface. Then apply and press a second layer of tape over first layer of tape.

c. Testing of Protective Coatings: Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester shall be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 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. 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.

d. Flanges: 150 pound weld neck, forged type 304 or 304L stainless steel flanges conforming to ASTM A182 and ANSI B16.5. Flanges to be 1/16 inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished.

2.2.2 Fittings:

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

2.2.2.2 Carbon Steel Fittings:

a. Fittings 2-1/2 inches and larger: butt weld, conforming to ASTM A234, grade WPB and ANSI B16.9 of the same wall thickness as the adjoining pipe.

b. Fittings 2 inches and smaller: forged (socket welded or if indicated on drawings, threaded), 2000 pound W.O.G., conforming to ASTM A105, Grade 2 and ANSI B16.11. Threaded fittings above grade only.

c. Flanges: 150 pound weld neck, forged flanges conforming to ASTM A181, Grade 2, and ANSI B16.5. Flanges to be 1/16 inch raised face with phonographic finish, except where required otherwise to match equipment furnished [or to connect to FRP pipe]. [Connections to FRP pipe to be made with flat face flanges.] Match flange face to valves or equipment furnished.

NOTE: OMIT REFERENCE TO FRP PIPE IF NOT USED.

2.2.2.3 Stainless Steel Fittings:

a. Fittings 2-1/2 inch and larger shall be butt weld type and shall be:

1) Stainless steel conforming to ASTM A403, Class WP-S, Grade WP 304L, seamless only and ANSI B16.9 of the same wall thickness as the adjoining pipe; or

2) Stainless steel conforming to ASTM A403, Class WP-WX Grade WP 304L, of wall thickness as indicated. Starting material shall not be fabricated by fusion welding process without addition of filler metal. No forming will be allowed using fusion welding process without addition of filler metal. Factory longitudinal weld shall be 100 percent radiographically inspected in accordance with ASME Boiler and Presser Vessel Code, Section VIII. Radiographs shall be submitted to the Contracting Officer.

NOTE: A CYCLIC FATIGUE ANALYSIS MUST BE PERFORMED BY THE DESIGNER TO DETERMINE WALL THICKNESS OF WELDED FITTINGS AND THE WALL THICKNESS SHALL BE SHOWN ON THE DRAWINGS. PRESSURES FOUND IN CERL MEMORANDUM FOR RECORD, SUBJECT: ANALYSIS OF HYDRANT FUELING SYSTEM FAILURES CAN BE USED.

b. Fittings 2 inch and smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 2000 pound W.O.G. conforming to ASTM A182 and ANSI B16.11. Threaded fittings above grade only.

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

d. Flanges: 150 pound weld neck, forged Type 304 or 304L stainless steel flanges conforming to ASTM A182 and ANSI B16.5. Flanges to be 1/16" raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished.

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

2.2.2.4 Isolating Gaskets Kits for flanges: Provide ASTM D229 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 0.03 inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125 inch thick high-strength pnenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5 inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Flanges separated by electrically isolating gasket kits shall be provided with weatherproof lightning surge arrester devices. Devices shall bolt

across flanges separated by insulating gasket kits. These arresters may be the gapped typed (Silicon carbide, etc.) or gapless type (metal oxide varistor), but must be able to withstand and pass at least 50,000 amperes and have a surge life of a minimum of 10,000 occurrences (IEEE Std. 587-1980 Cat A waveform) at not less than 200 amperes. Gapped arresters must be encapsulated so as to be sealed from the atmosphere. Clamping voltage shall be approximately 100 volts. Maximum sparkover voltage shall not exceed 3.6 KV at 30,000 Amps. Wire leads shall be not less than 10 AWG copper and must not exceed twelve inches in length. Current drain of gapless type must be less than 100 microamps. Response time shall be not greater than 10 nanoseconds. Temperature range for successful operation shall be approximately from -31 degrees F (-35 degrees C) to 167 degrees F (75 degrees C). Mount the arrester assembly to prevent movement. 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
2"	5/8"
2-1/2"	5/8"
3"	5/8"
4"	5/8"
6"	3/4"
8"	3/4"
10"	7/8"
12"	7/8"

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

2.2.3 Bolts and Nuts: Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall be stainless steel and conform to ANSI Standards B18.2.1 and B18.2.2, except as otherwise specified. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ANSI Standard B18.2.1 with material conforming to ASTM Specification A193, Class 1, Grade B8. Bolts shall be threaded in accordance with ANSI Standard B1.1, Class 2A fit, Coarse Thread Series, for sizes 1 inch and smaller and 8 Pitch Thread Series for sizes larger than 1 inch. Nuts shall conform to ANSI B18.2.2, hexagonal, heavy series with material conforming to ASTM Specification A194, Grade 8. Nuts shall be threaded in accordance with ANSI Standard B1.1, Class 2B fit, Coarse Thread Series for sizes 1 inch and smaller and 8 Pitch Thread Series for sizes larger than 1 inch. Provide washers under bolt head and nuts. Washers to be ASTM F 436, flat circular stainless steel. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer.

2.2.4 Gaskets: ANSI B16.21, composition ring 0.0625-inch thick. Gaskets shall be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets shall be used for flat-face flanged joints. Ring gaskets shall be used for raised-face flanged joints. Gaskets shall be of one piece factory cut.

2.2.5 Relief and Drain System Piping: Pressure relief valve discharge lines and drain lines to the product recovery tank shall be Schedule 40 stainless steel conforming to A312 Type 304L or where indicated Schedule 40 API 5L Grade B or ASTM A53 Grade B Carbon Steel.

2.2.6 Gaskets: See Gaskets specified hereinbefore.

2.2.7 Relief and Drain System Protective Coating: Pipe shall be factory coated as specified hereinbefore for carbon steel and stainless steel piping.

2.2.8 Field Applied Protective Coatings: The field joints and fittings of all carbon and stainless steel underground piping shall be coated as herein specified.

2.2.8.1 Welded Joints: Heat shrinkable radiation-cross-linked polyolefin wraparound type sleeves shall be applied to all welded joints. Joints shall not be coated until pressure testing is complete.

Apply sleeves consisting of 40 mil polyolefin backing and 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.2.8.2 Fittings: Fittings and other irregular surfaces shall be tape wrapped. The tape shall be plastic mastic laminated tape having 6 mil plastic backing of either polyethylene or polyvinyl chlorine and 29-44 mil of synthetic elastomer.

2.2.9. Screw Joints: Screw joints, if indicated on the drawings, shall be made tight with manufacturer recommended teflon tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to the male threads. Not more than three threads shall show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping.

2.2.10 Welded Joints: Welded joints in steel pipe and stainless steel pipe shall be as specified in PART 3 - EXECUTION.

2.3 MANUAL VALVES: All portions of a valve coming in contact with fuel shall be of noncorrosive material. All valves shall be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Stem and trim shall be stainless steel for all valves. Manually operated valves 6 inches and larger shall be worm-gear operated and valves smaller than 6 inches shall be wrench operated. Valves smaller than 2 inches shall have lever-type handles except where indicated to be deadman type, spring return handles.

2.3.1 Ball Valves: Shall be fire tested and qualified in accordance with the requirements of API Standard 607. Ball valves shall be non-lubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves 2 inches and larger shall conform to applicable construction and dimension requirements of API Specification 6D, ANSI Class 150 and shall have flanged ends. Valves smaller than 2 inches shall be ANSI Class 150 valves with one piece bodies with flanged ends, unless noted otherwise. The balls in valves 10 inches 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. Minimum bore shall not be less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter.

2.3.1.1 Materials: Ball shall be stainless steel. Ball valves shall have tetraflouroethylene (TFE) or Viton seats, body seals and stem seals.

2.3.2 Plug (Double Block and Bleed) Valves: API 6D and MIL-V-12003 Type III, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve shall have stainless steel or carbon steel body with chrome-plated interior, tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower 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. Minimum bore size shall be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal or better flow characteristics of the reduced bore size design.

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

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

2.3.2.3 Relief Valves: ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves shall open at 25 psi differential pressure and shall discharge to the throat of, and to the upstream side of, the plug valve. [Provide integral ball check type around the body bleed.]

NOTE: INTEGRAL BALL CHECK AROUND BODY BLEED REQUIRED IF NO PROVISIONS TO RELIEVE PRESSURE IN DOWN STREAM PIPING EXIST. RELIEF IS FOR THERMAL EXPANSION.

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

2.3.3 Gate Valves: API 6D, ANSI Class 150. Valves shall conform to fire test requirements of API RP 6F. Valves shall be of the flexible wedge disc type, conduit disc type, or double disc type. Valves shall be of the rising stem type with closed yoke, or of the nonrising stem type equipped with a device to give positive visual indication of the valve's position.

2.3.3.1 Gate Valves for diked area drain lines shall be cast steel, with extension as required, outside screw and yoke valves, conforming to API 6D, regular type, Class 150. Diked area drain valves shall have locks.

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

2.3.5 Angle Relief Valves shall be the fully enclosed coil spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and shall be labeled in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Valve stems shall be fully guided between closed and fully opened positions. The valves shall be factory-set to open at the set pressure noted on the drawings. Operating pressure shall be adjustable by means of an enclosed adjusting screw. The valves shall have a minimum capacity of 20 gpm at 10 percent over pressure and shall operate at rated capacity with a back pressure not exceeding 50 psi.

2.3.5.1 Materials: Valves that have both their inlets and outlets connected to stainless steel pipe shall be stainless steel construction and valves that have their outlets connected to carbon steel pipe shall have carbon steel bodies and bonnets with stainless steel springs and trim. Valves shall be Class 150 flanged end connections.

2.3.5.2 Sight Flow Indicators: Sight flow indicators shall be ANSI Class 150 and shall have flanged ends 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.

[2.3.6 Butterfly Valves: API 609 minimum ANSI Class 150. Conform to fire test requirements of API 607. Design for bubbletight bidirectional shutoff service at maximum pressure rating. Teflon with metal backup seal ring. Stem seals capable of withstanding the rated pressure and temperature of the valve seat. Provide fusible link type valve operator. Provide fusible link and coiled spring assembly to close the valve automatically when the link material melts at 165 degrees F and to lock the valve in the closed position. Spring assembly shall be fully enclosed to ensure safety.]

NOTE: CONSULT WITH COMMAND FUEL FACILITIES ENGINEER FOR USE OF THIS VALVE. SOLE FUNCTION IS FOR FIRE PROTECTION SAFETY.

2.4 PIPING ACCESSORIES:

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

2.4.2 Pipe Penetration Sleeves: Pipe sleeves shall be installed at all points where the piping passes through concrete construction. Such sleeves shall be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2 inch. Sleeves through concrete pits or slabs shall be 20 gauge galvanized metal. Each sleeve shall extend through the respective pit wall or slab and shall be provided with a Buna-N casing seal. Alignment of the sleeve and piping shall be such that the pipe is accurately centered within the sleeve by a 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 with the inside wall or slab.

2.4.3 Strainers: Mil. Spec. MIL-S-13789, except as specified otherwise. Strainer end connections shall be designed in accordance with ANSI B16.5, Class 150. Strainers shall have stainless steel bodies, stainless steel shall be Types 304 or 316. Strainers shall have removable baskets of 60 mesh wire screen with larger wire mesh reinforcement; wire shall be stainless steel, Type 316. Pressure drop for clean strainer shall not exceed 3 psig at design flow rate. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than 3 to 1. Each strainer shall be provided with a suitable drain at the bottom, equipped with a ball valve. Strainer shall be the [single inlet, single outlet] [duplex inlet, duplex outlet] design. Strainer shall be supplied with a piston type direct reading differential pressure gage as specified in Section entitled "Filter Separator".

NOTE: SELECT SINGLE OR DUPLEX STRAINER.

2.4.4 Pipe Hangers and Supports:

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

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

2.4.4.3 Low Friction Supports: Low Friction Supports shall be self-lubricating anti-friction element composed of reinforced Teflon. Units shall be factory designed and manufactured. Low friction support tee shall be of same construction material as pipe.

2.4.4.4 Concrete and grout for anchors and supports shall comply with Section, ["Cast-In-Place Concrete".] ["Concrete for Building Construction"].

NOTE: SELECT "CAST-IN-PLACE" FOR NAVFACENGCOM PROJECTS OR "CONCRETE FOR BUILDING CONSTRUCTION" FOR C.O.E. PROJECTS.

2.4.5 Sample Connections: Sample connections shall be factory assembled units specifically designed for obtaining representative

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

2.4.5.1 Sampling Hoses: Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly shall consist of a six foot length of 1/4 inch clear plastic tubing with internal bonding/grounding wire. One end of tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire shall be equipped with clips for attaching to the pipe and metal sample container.

2.5 FLEXIBLE HOSES: Flexible hoses for fueling pumps shall have ANSI Class 150 flanges of stainless steel construction conforming to ANSI B16.5. Flexible hoses shall be of stainless steel flexible metal hose consisting of an inner corrugated stainless steel tube with stainless steel braid cover. All components to be suitable for not less than 275 psig. Length and application of flexible hoses shall be per manufacturer's written recommendations.

PART 3 - EXECUTION

3.1 WELDING:

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

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

3.1.1.2 Symbols shall be in accordance with AWS A2.4 for welding and non-destructive testing, unless otherwise indicated.

3.1.1.3 Safety precautions shall conform to ANSI Z49.1.

3.1.1.4 Weld preparation shall comply with the requirements of ANSI B31.3 and the qualified Welding Procedure Specification. The use of

"rice paper" as purge blocks is not permitted. Contractor shall submit alternate method for approval.

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

3.1.2 Qualification of Welders: Welders and welding procedures shall be qualified in accordance with requirements of ANSI B31.3.

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

3.1.2.2 Defective Work: Welders found making defective welds shall be removed from the work or shall be required to be requalified in accordance with ANSI B31.3.

3.1.3 Tests: All welds shall be examined by radiographic methods to determine conformance to the paragraph entitled "Standards of Acceptance". The services of a qualified commercial or testing laboratory approved by the Contracting Officer shall be employed by the Contractor for testing of piping welds. Costs of testing, including retesting or repaired welds, shall be borne by the Contractor.

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

3.1.4 Standards of Acceptance: Interpretation of test results and limitations on imperfections in welds shall comply with the requirements for "100% Radiography", ANSI B31.3.

3.1.5 Corrections and Repairs: Defects shall be repaired in accordance with approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Whenever a defect is removed and repair by welding is not required, the affected area shall be blended into the surroundings 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 re-evaluation by non-destructive methods and/or by surface conditioning shows that no defect is present.

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

a. Excessive convexity and overlap: Reduce by removal of excess metal.

b. Excessive concavity of weld, undersized welds, undercutting: Clean and deposit additional weld metal.

c. Excessive weld porosity, inclusions, lack of fusion, incomplete penetration: Remove defective portions and reweld.

d. Crack in weld or base metal: Remove crack throughout its length, including sound weld metal for a distance of twice-the thickness of the base metal or 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 ANSI B31.3.

e. Poor fit-up: Cut apart improperly fitted parts, and reweld.

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

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

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

3.2 INSTALLATION:

3.2.1 Protective Coatings:

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

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

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

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

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

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

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

3.2.1.2 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 3 inches back from each edge of the extruded polyethylene coating. For pipe less than 4 inch size, one layer half-lapped shall be used. For pipe 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.

3.2.1.3 Inspection and Testing: The condition of factory field coated and wrapped piping shall be the responsibility of the Contractor and all damage to the protective covering during transit and handling shall be repaired by the Contractor at no additional cost. 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 entitled "Testing of Protective Coatings" under paragraph "Protective Coatings for Buried Carbon Steel and Stainless Steel Piping". The inspection for holidays shall be performed just prior to lowering the pipe into the ditch and every precaution shall be taken during lowering and back filling to prevent damage to the protective covering.

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

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

3.4 CLEANING OF PIPING: The Contractor shall keep the interior and ends of all new piping affected by the Contractor's operations thoroughly cleaned of foreign matter and water before and after being installed. Piping systems shall be kept clean during installation by

means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water or other foreign substance will enter the pipes or fittings. Piping shall be inspected before placing into position. It shall be the Contractor's responsibility for insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.5 TRENCHING AND BACKFILLING: Trenching and backfilling shall conform to Section entitled ["Excavation, Backfilling and Compacting for Utilities"] ["Excavation, Trenching and Backfilling"], and the following bedding and backfill requirements. The pipe shall be laid in a bed of sand 6 inches deep, compacted to the elevation of the bottom of the pipe. The full length of each section of pipe shall be excxavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, shall be taken up and relaid. Pipe shall not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill shall be placed and compacted around the pipe or protective coating. The remainder of the backfill shall be the same as for other types of pipe.

NOTE: SELECT "EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES" FOR NAVFACENGCOM PROJECTS OR "EXCAVATION, TRENCHING AND BACKFILLING" FOR C.O.E. PROJECTS.

NOTE: FOR LATERALS, THE SLOPE SHALL BE AT LEAST 0.5.

3.6 INSTALLATION OF UNDERGROUND PIPE: Underground fuel pipelines shall be pitched as shown on the drawings. Where not indicated they shall be pitched minimum of 2 inches per 100 feet. Two-inch pipe size valved drain connections shall be provided at all low points and 1-1/2 inch pipe size valved outlet vent connections shall be provided at all high points. Vent and drain lines shall terminate in male cam-type locking ends with matching female dust covers. The pipe shall have a cover as shown on the drawings. Drain lines shall be installed at the slopes indicted.

3.6.1 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.

3.6.2 Warning Tapes: Warning tapes shall be provided and shall be as specified in Section entitled ["Excavation, Backfilling and Compacting for Utilities"] ["Excavation, Trenching and Backfilling"].

NOTE: SELECT "EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES" FOR NAVFACENGCOM PROJECTS OR "EXCAVATION, TRENCHING AND BACKFILLING" FOR C.O.E. PROJECTS.

3.6.3 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 6 inches, install an insulating separator. Protect the pipe from contact with a 12 inch square by 1 inch thick bituminous-impregnated cane-fiber board.

3.7 PIPING LAYOUT REQUIREMENTS:

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

3.7.2 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.

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

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

3.7.5 Piping and equipment. Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and support 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.

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

3.7.7 Where invert elevations of piping lines are shown on the drawings grade the line uniformly between invert elevations. Maintain gradient to within plus or minus 1/4 inch over the entire length of pipe.

3.7.8 Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100% radiographic inspection may be used. Do not use weldolets unless indicated on the drawings.

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

3.8 TESTING: Piping shall be tested by pneumatic and hydrostatic pressure. Testing shall comply with applicable requirements of ANSI 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.

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

3.8.1.1 Pneumatic Test Procedure: Special safety measures, including the wearing of face mask, shall be taken during testing under pressure. Only authorized personnel shall be permitted in the area during testing. The pneumatic test pressure shall be applied in increments. A preliminary 25 psig test shall be applied. Examine joints with soap solution. Leaks revealed by this test shall be repaired. The full test pressure shall then be applied. Unless otherwise directed by the Contracting Officer, all piping shall be tested at a pressure of [50] [100] psig for not less than two 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.

NOTE: SELECT PSIG PER DECISION OF THE COMMAND FUEL FACILITIES ENGINEER.

3.8.1.2 Hydrostatic Test Procedure: Upon completion of pneumatic testing and after backfilling, hydrostatically test each piping system with fuel at not more than 275 psig in accordance with ANSI B31.3 and API RP 1110, with no leakage or reduction in gage pressure for 4 hours. The Contractor shall furnish electricity, instruments, connecting devices, and personnel for test. Fuel shall be furnished by the Government. Defects in work provided by the Contractor shall be corrected by him at his own expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

3.8.2 Performance Testing: The completed fuel system shall be cleaned and performance tested as specified in Section entitled "Start Up System". All control valves, both manual and automatic, shall be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

- END OF SECTION -